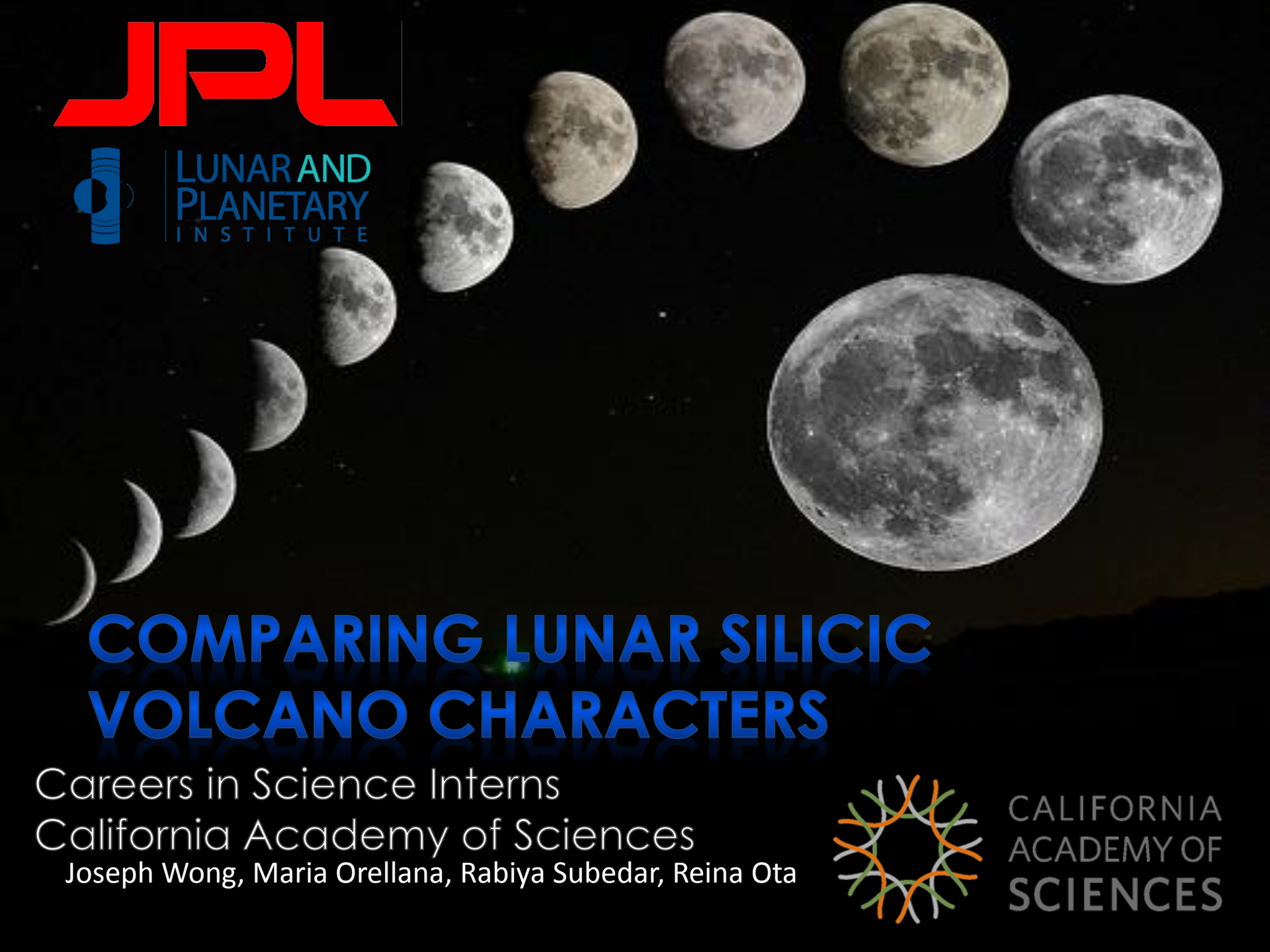


COMPARING LUNAR SILICIC VOLCANO CHARACTERS

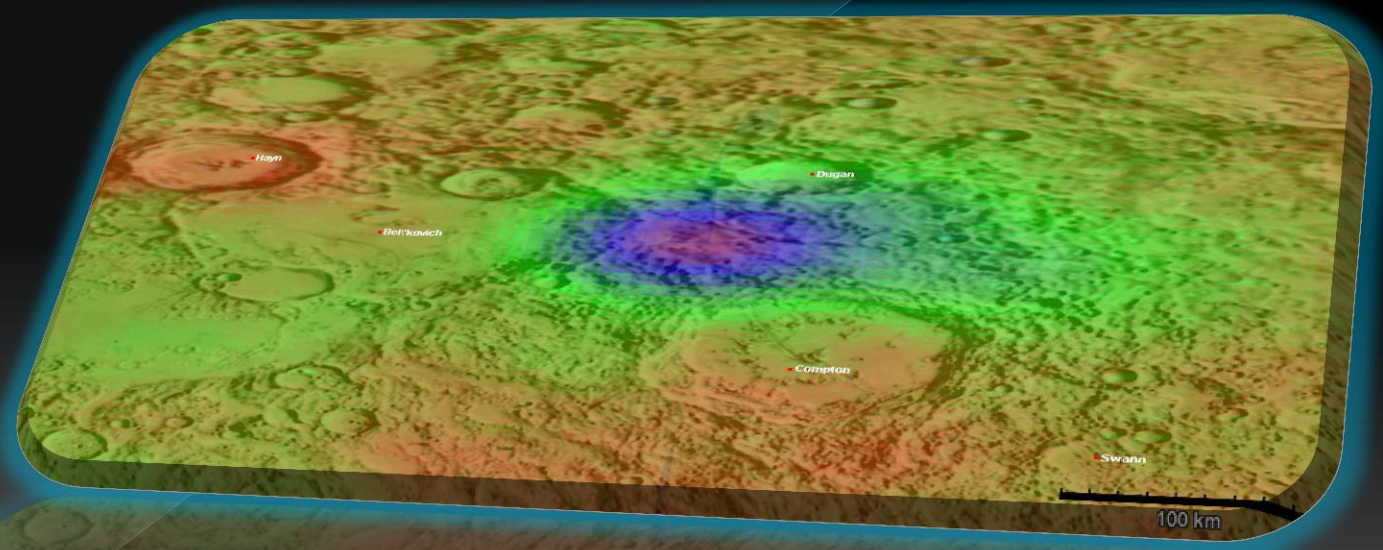
Careers in Science Interns
California Academy of Sciences
Joseph Wong, Maria Orellana, Rabiya Subedar, Reina Ota

Big Topics

- Research Question
- Introduction
  - Silicic Volcanoes and significance
  - Characteristics: Albedo, Elevation, Thorium concentration & Distance from Th deposit, Surrounding Geography/Geology
- Methodology
- Locations of Study
- Analysis / Conclusion

Research Question

How unique is CBF (Compton-Belkovich Feature) from other silicic volcanoes?



Introduction

- What are silicic volcanoes?
  - Magma or igneous rocks rich in silica
    - Rocks w/ 65% silica deemed silicic
- Why are they significant on the moon?
  - Abundance is low; not prevalent
  - Usually only found on nearside
  - One spot on far side
  - potential and ongoing research

What is albedo?

- "Whiteness" or reflected sunlight
  - Reflected power of a surface
- Ratio of reflected radiation from the surface to incident radiation upon it
- Calculate the reflected light of surface
  - On moon values divided by 10,000

Earthshine on the Moon. Image credit: Drew J. Evans

What is Elevation?

- Altitude of or height of something above a certain level
- Comparisons (i.e. forms, shapes, size) of terrestrial examples
- Important to follow similar measures

Significance of Thorium concentration and distance from Th deposit

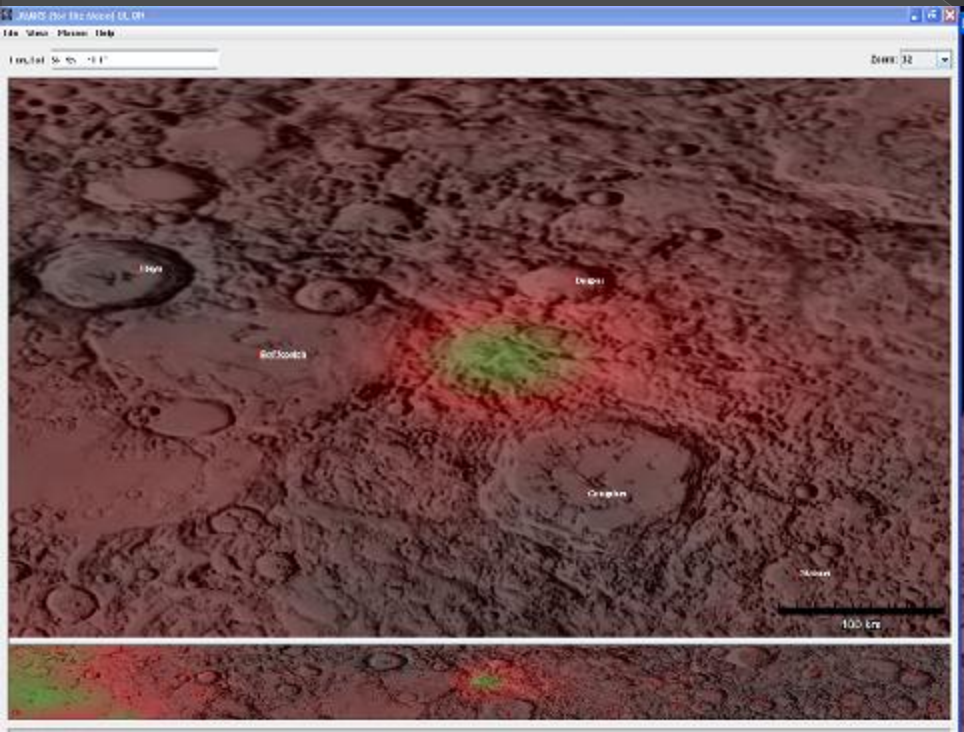
- Thorium present on all lunar silicic volcanoes
- To see the lunar volcanoes differ from the Compton Belkovitch on the farside
- Thorium concentration was measured in ppm(parts per million)

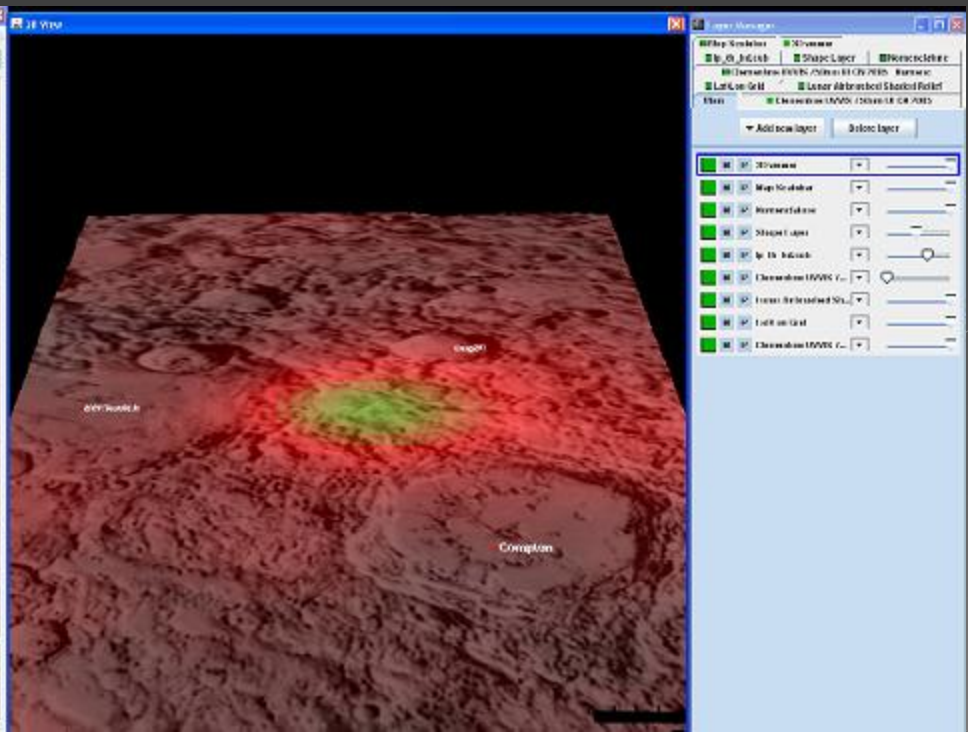
Surrounding Geology

- What kind and how many craters are in a given area
- Abundance of FeO **Iron(II) oxide**
- Abundance of TiO2 **Titanium dioxide**

Methodology

- JMARS (for the moon)
  - Plugged in coordinates
  - Use various datasets
    - Changed color aspects
  - Gathered quantitative data
    - (i.e. MAX, MIN, STDEV, SUM)
  - Graphed and Analyzed Data



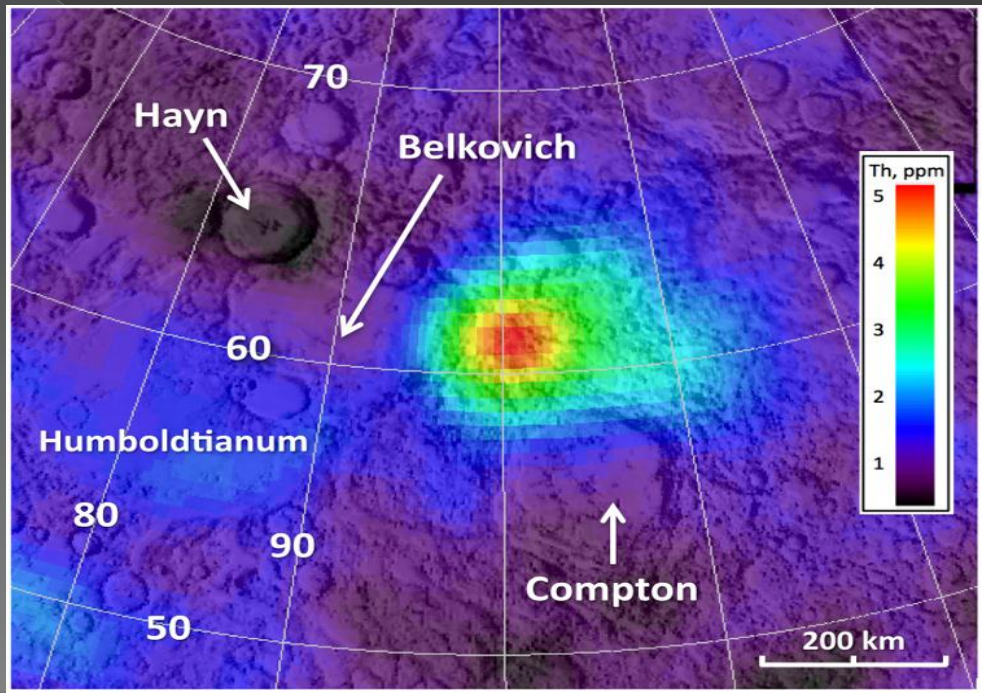


Locations of Study

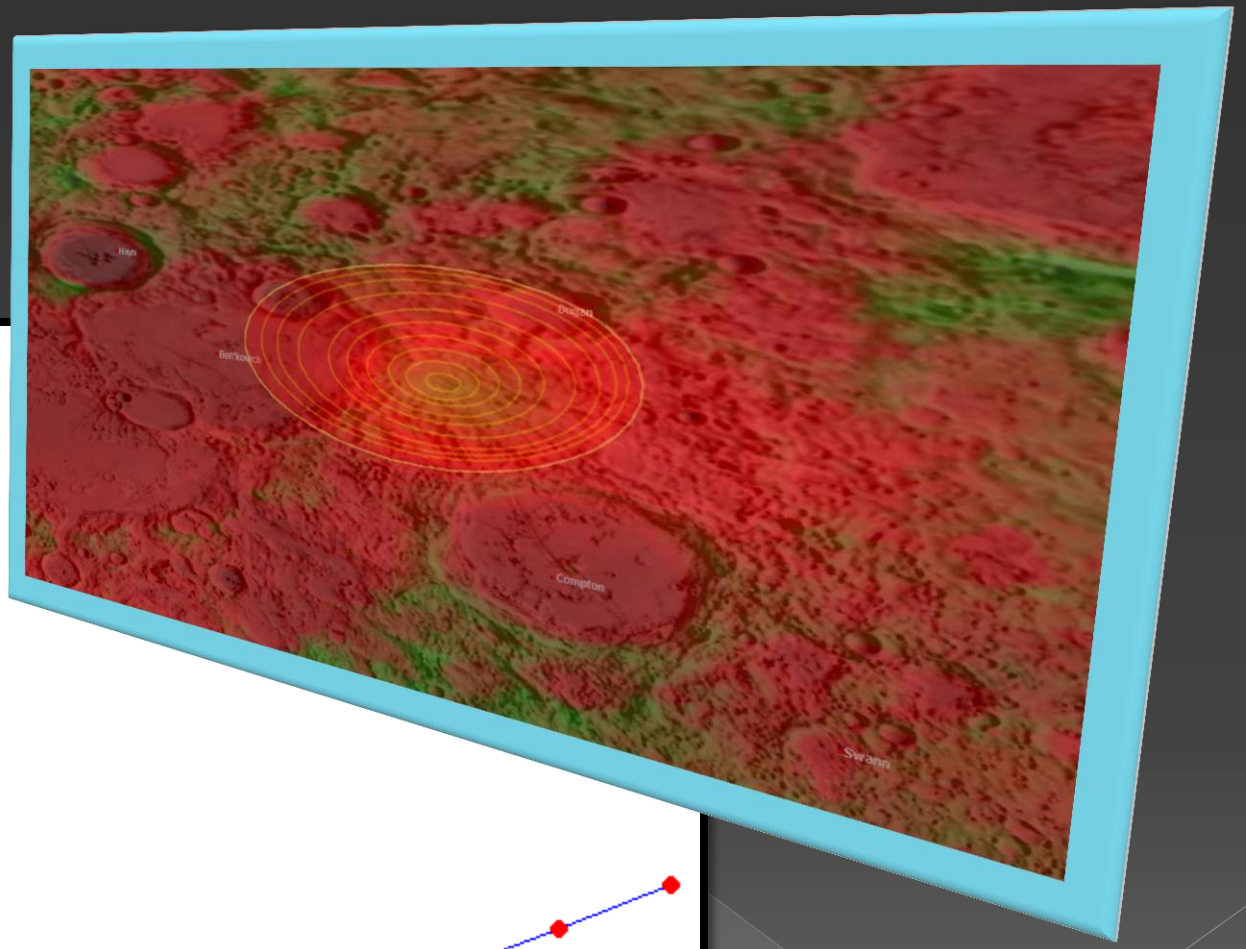
- Silicic
  - Farside: Compton-Belkovich (99.45, 61.11)
  - Nearside: Hansteen Alpha (309.8, -12.3), Aristarchus (4724, 27.7), Montes Riphaeus (28.1, -7.7)
- Basaltic
  - Mons Rumker (30.19, 40.8)

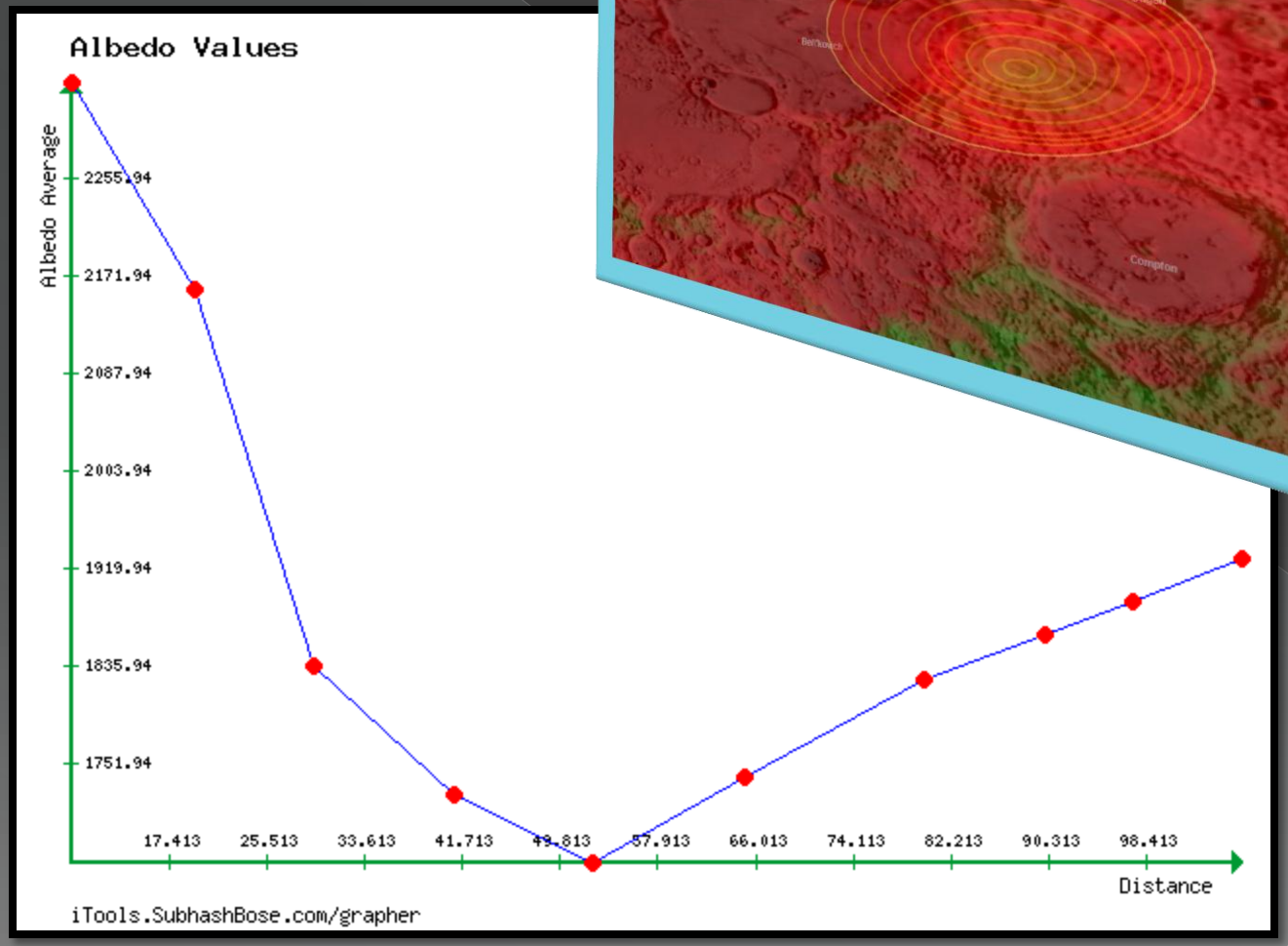
Compton-Belkovich

- Silicic Volcano
- Farside
- Only Farside Silicic Volcano
- Found fairly recent

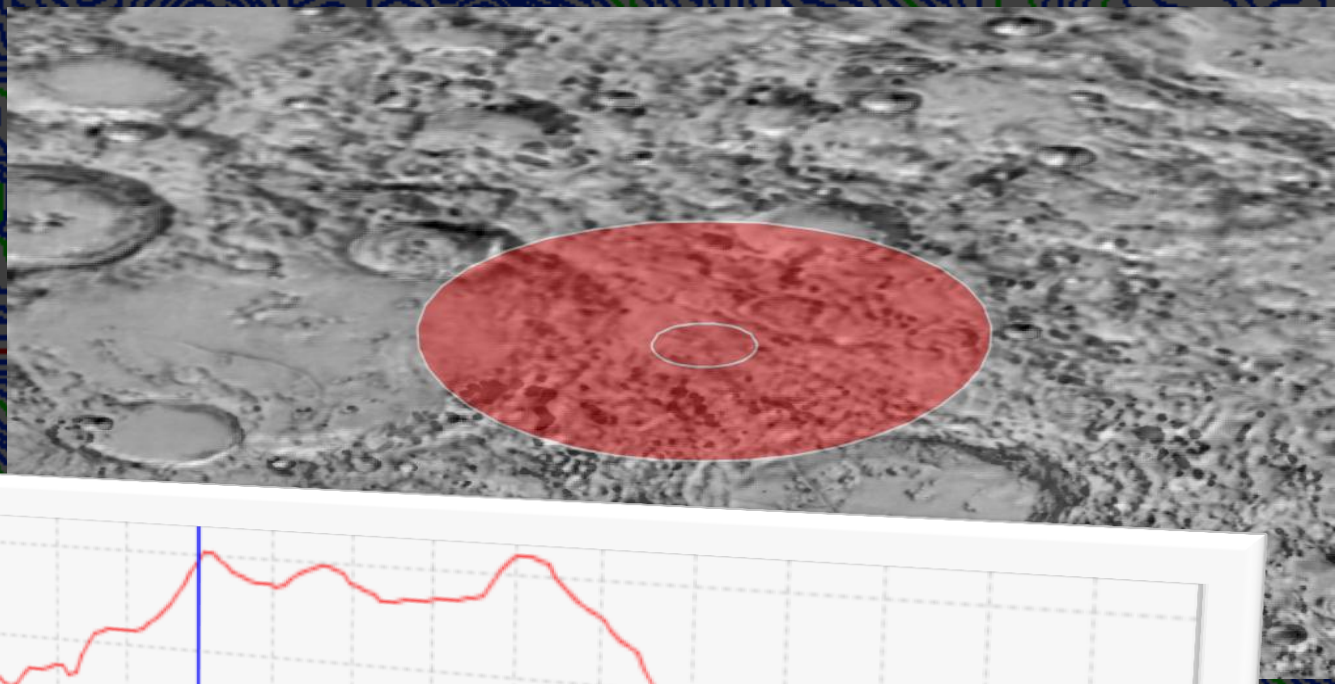


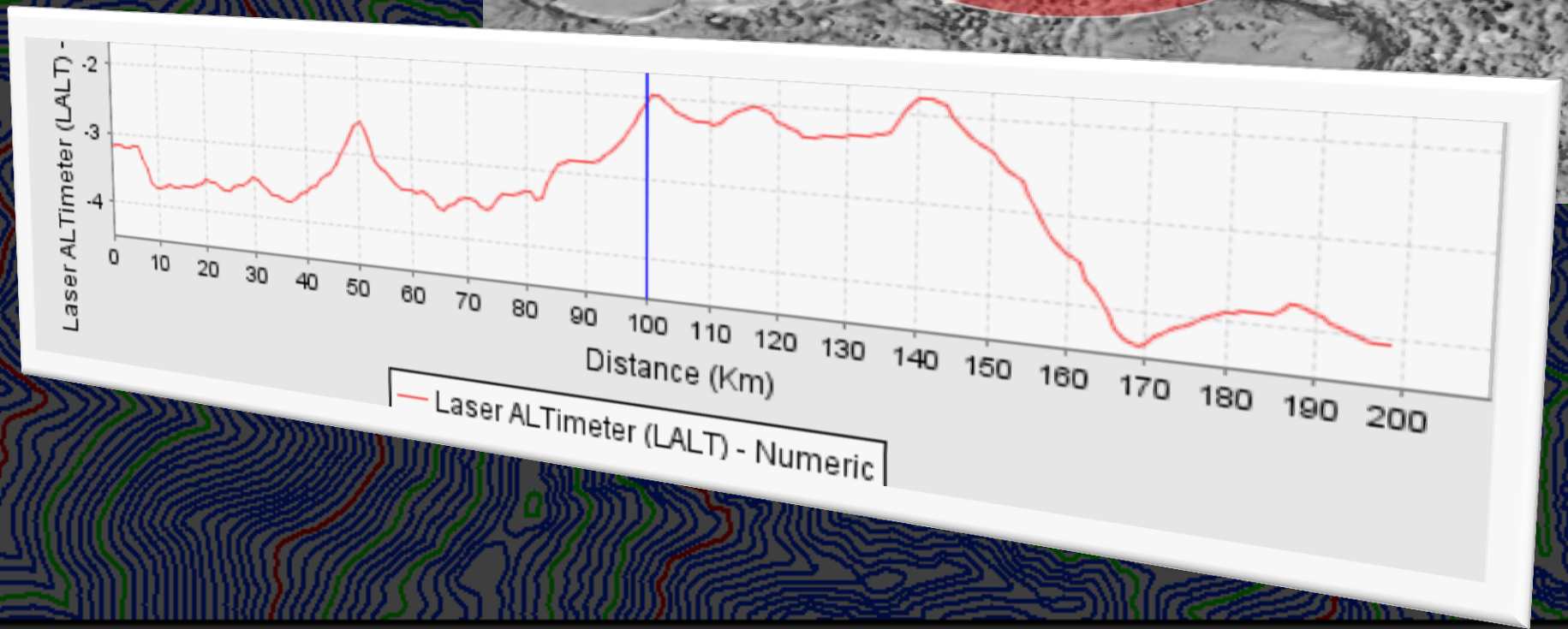
Compton-Belkovich Albedo



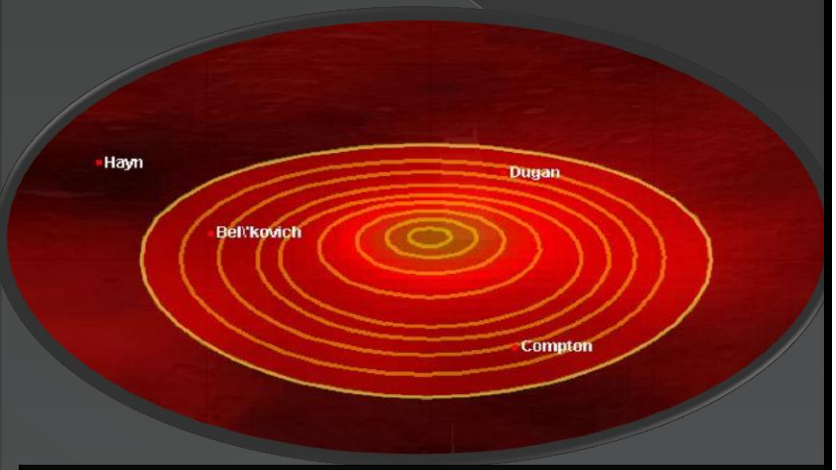


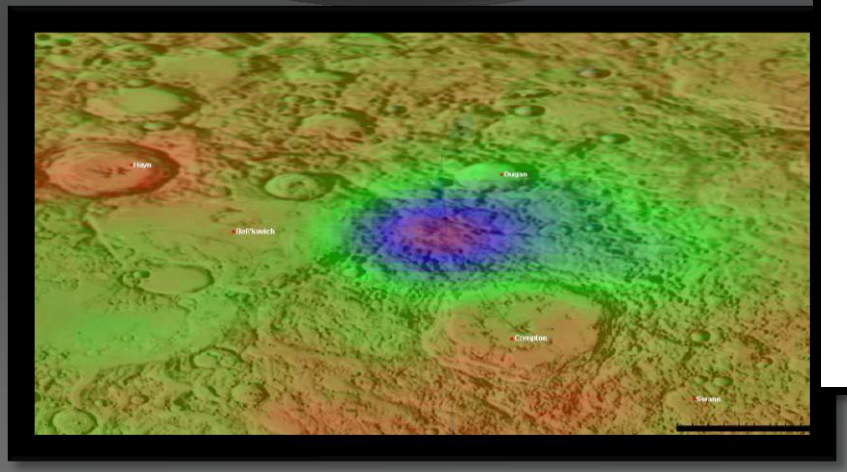
Compton-Belkovich Elevation

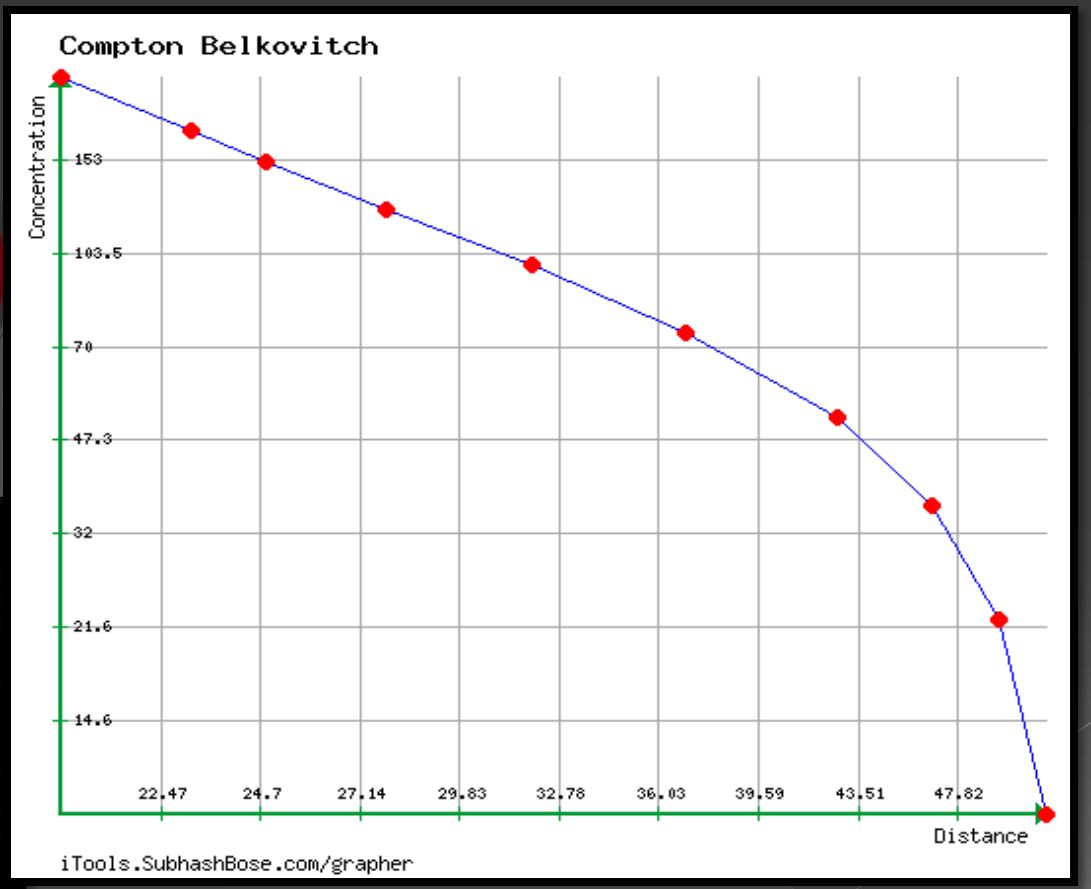




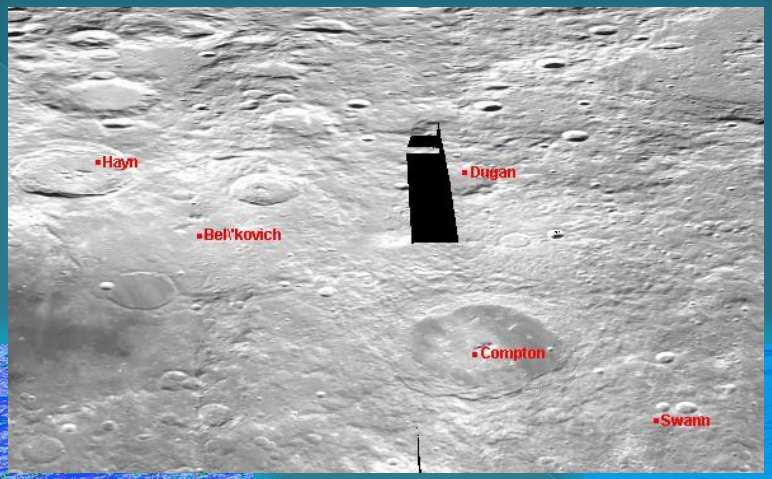
Compton-Belkovich Th Deposits

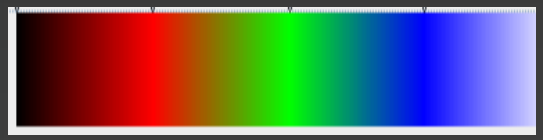


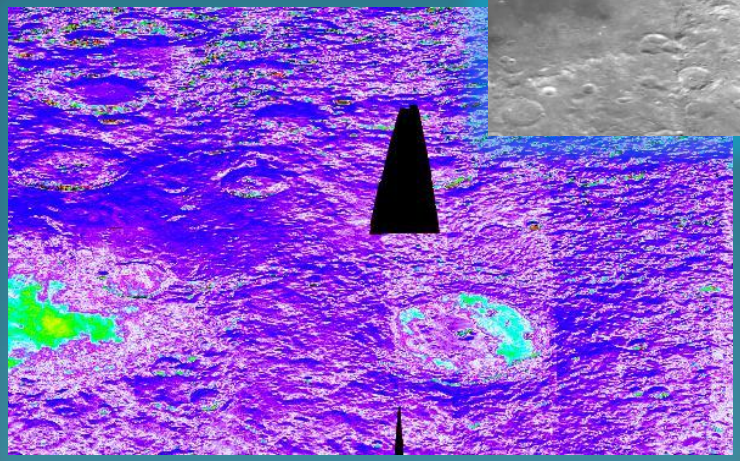




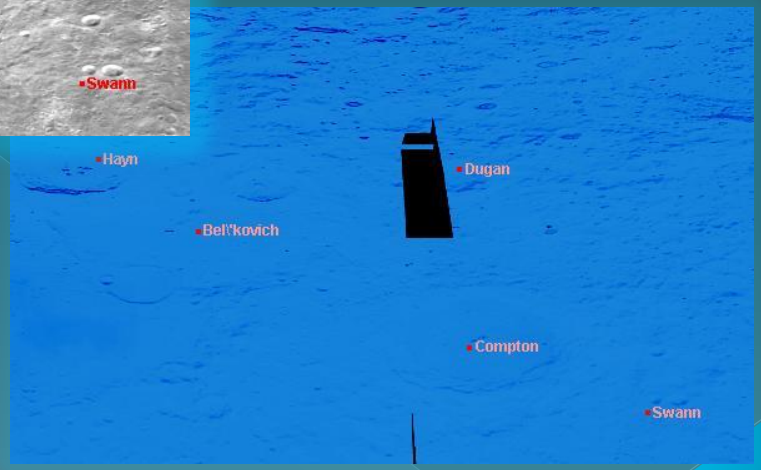
Compton-Belkovich







FeO Iron(II) oxide Abundance (Dark-Low, Light- High)

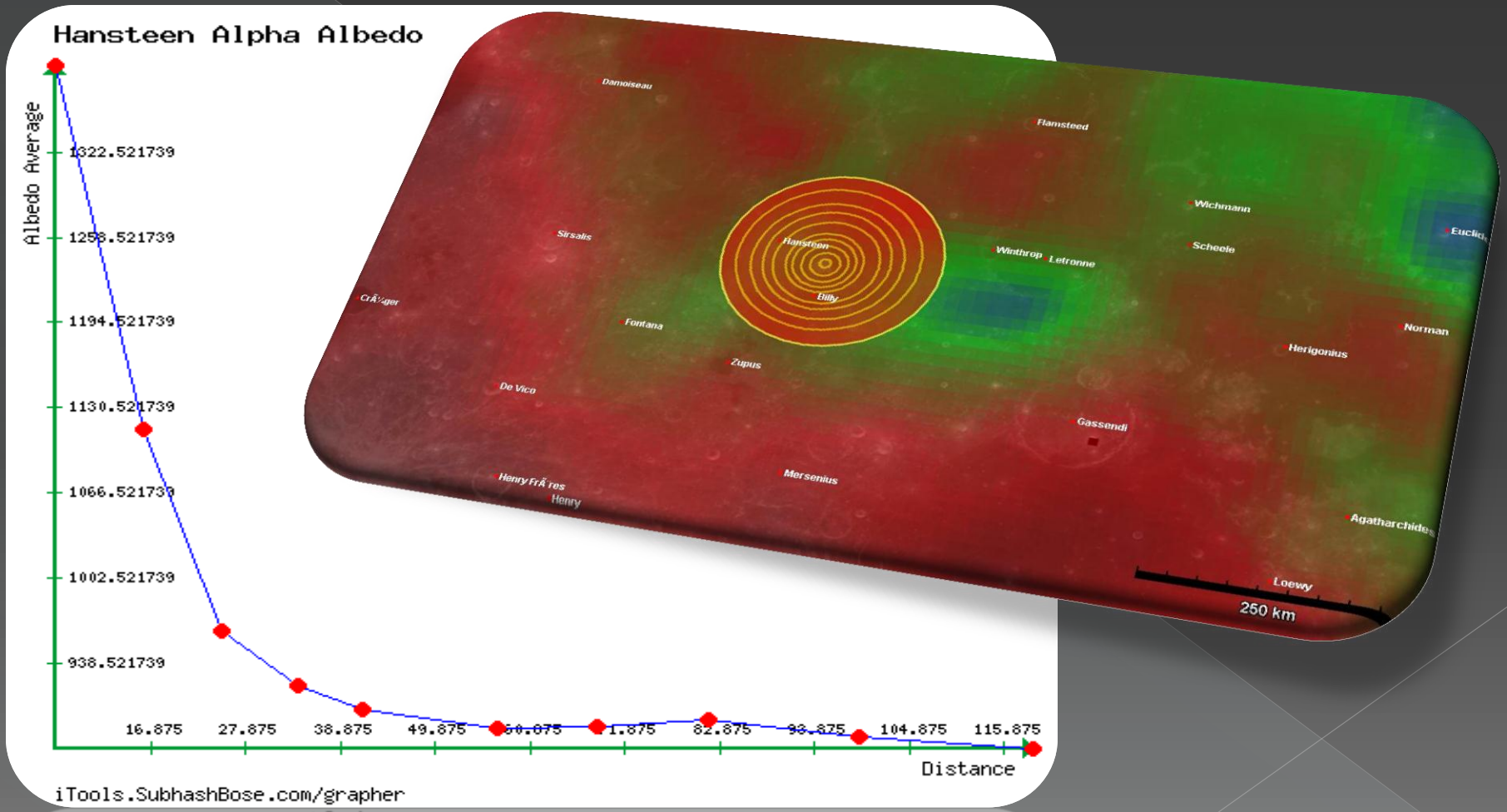


TiO2 Titanium dioxide Abundance: Light Blue- High, Dark Blue- Low

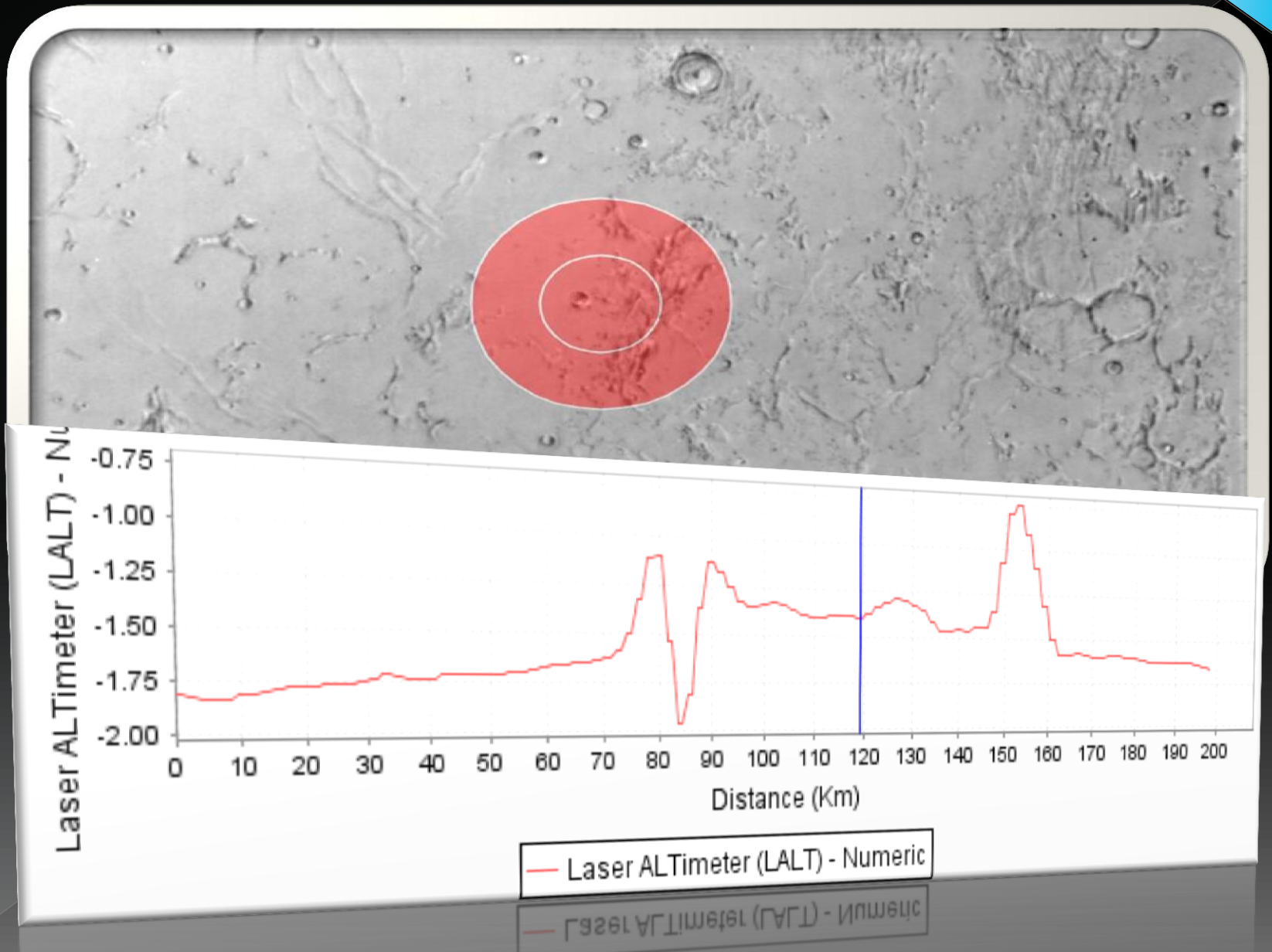
Hansteen Alpha

- Part of KREEP tarrae
- Near floor fractured crater
- Nearside of moon
- Cluster of Silicic Volcanoes
- High Th Concentration
- In particular locale with many others

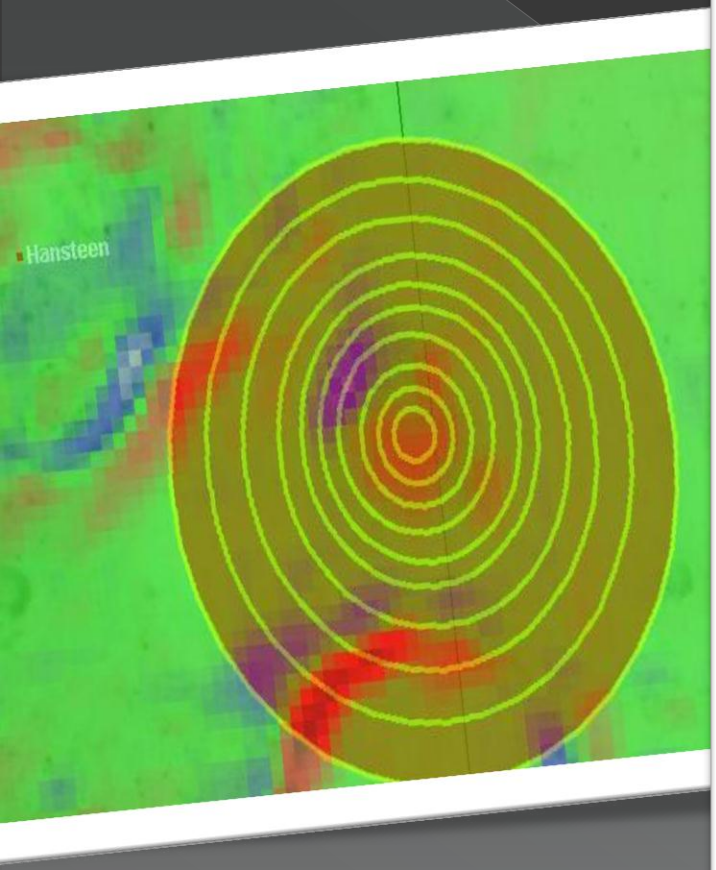
Hansteen Alpha Albedo

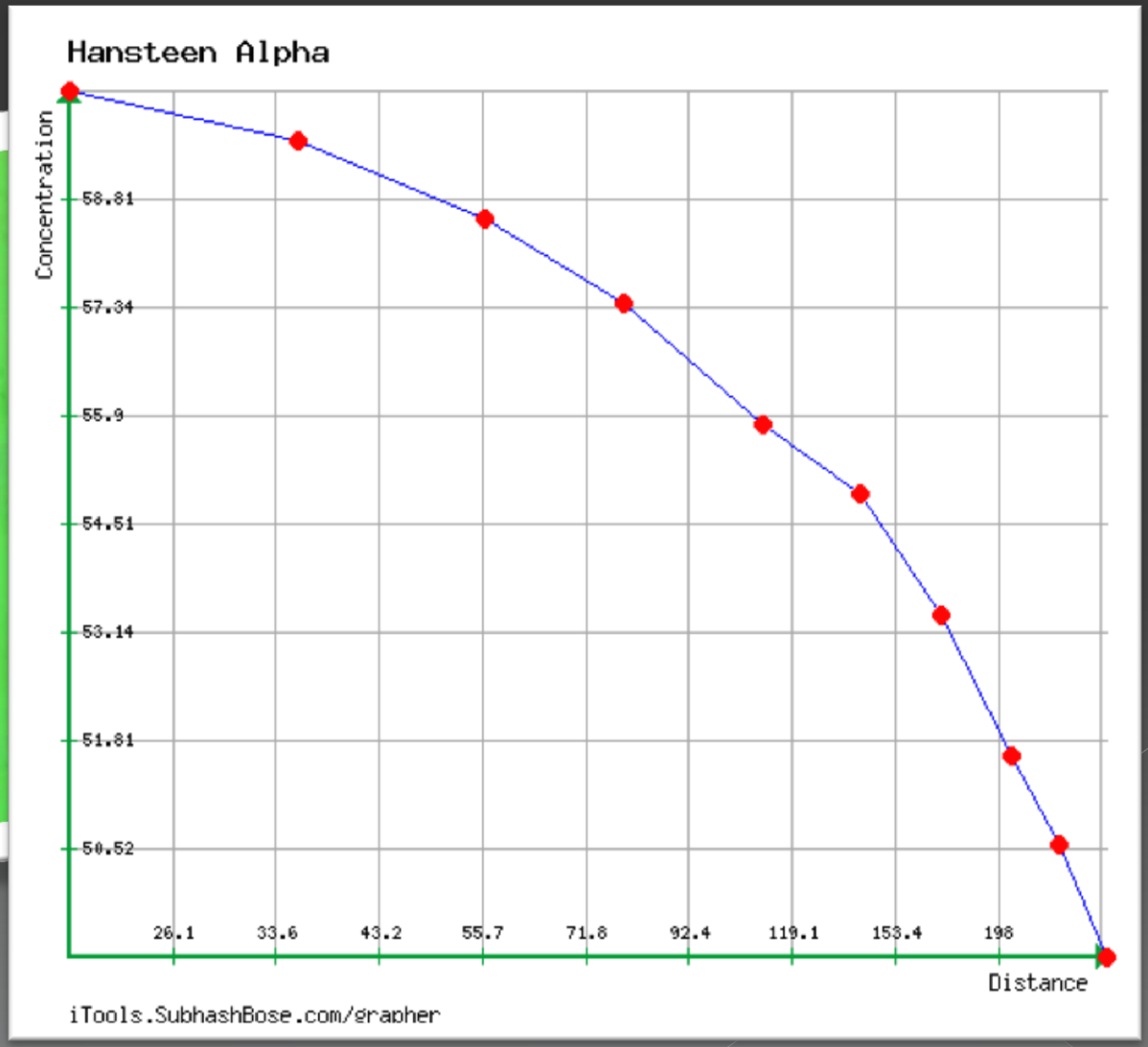


Hansteen Alpha Elevation

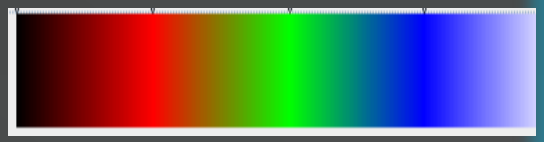


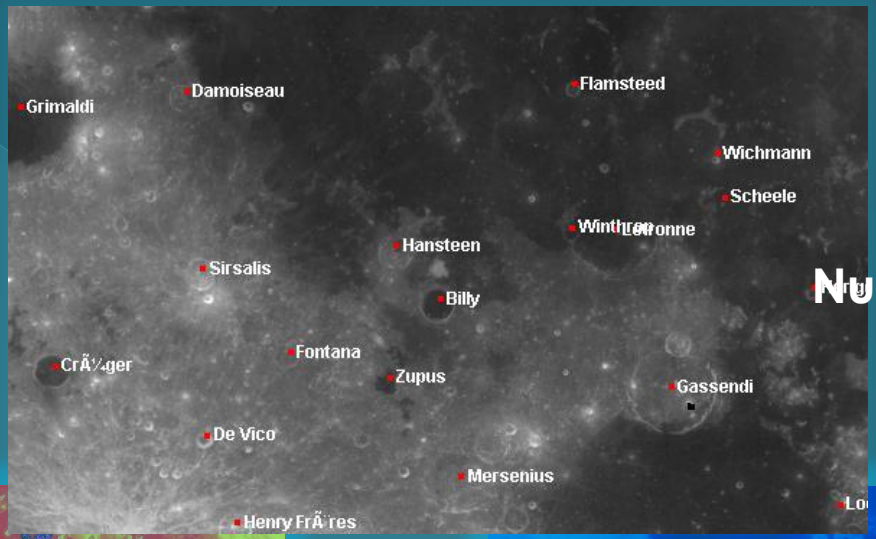
Hansteen Alpha Th Deposits



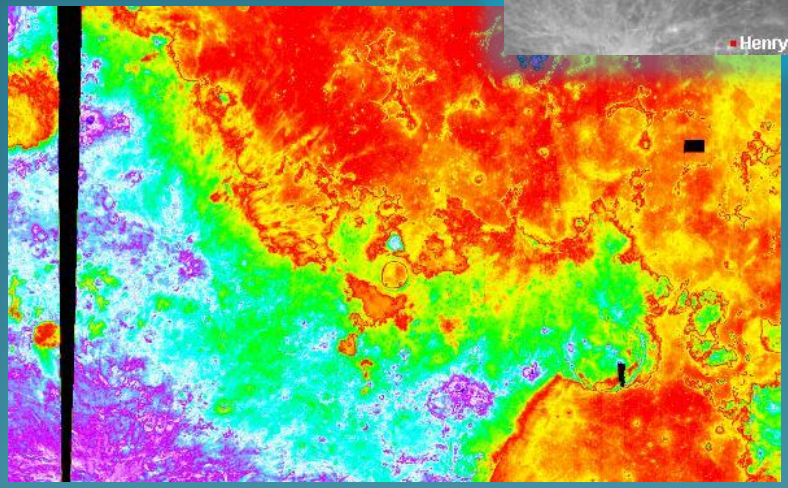


Hansteen Alpha

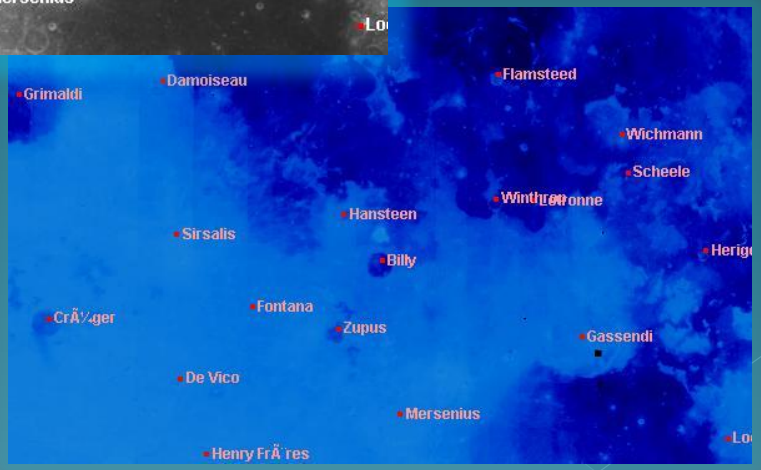




Number of Craters (18)



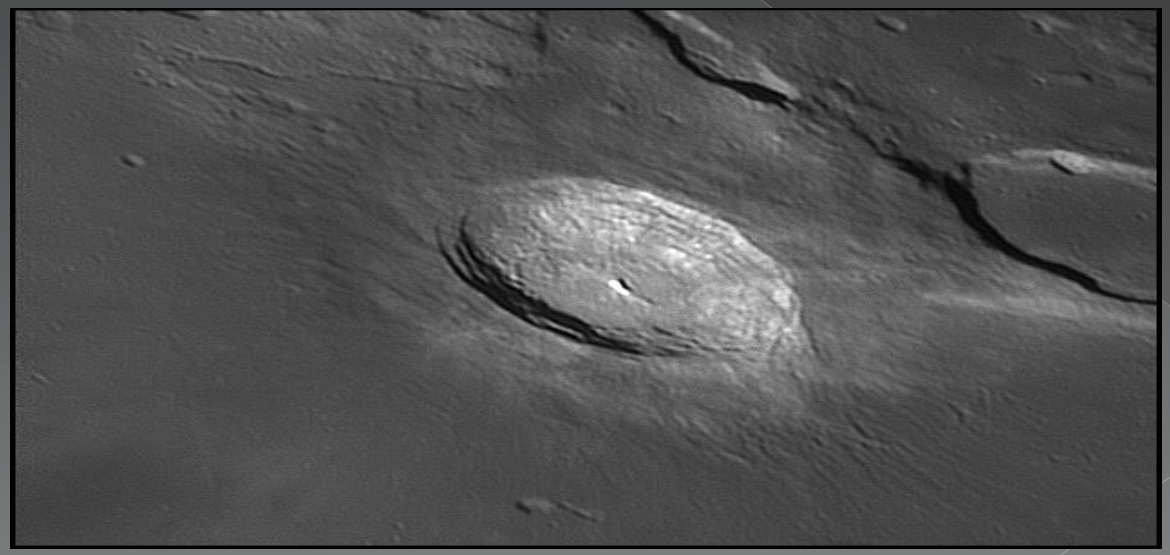
FeO Iron(II) oxide Abundance (Dark-Low, Light- High)



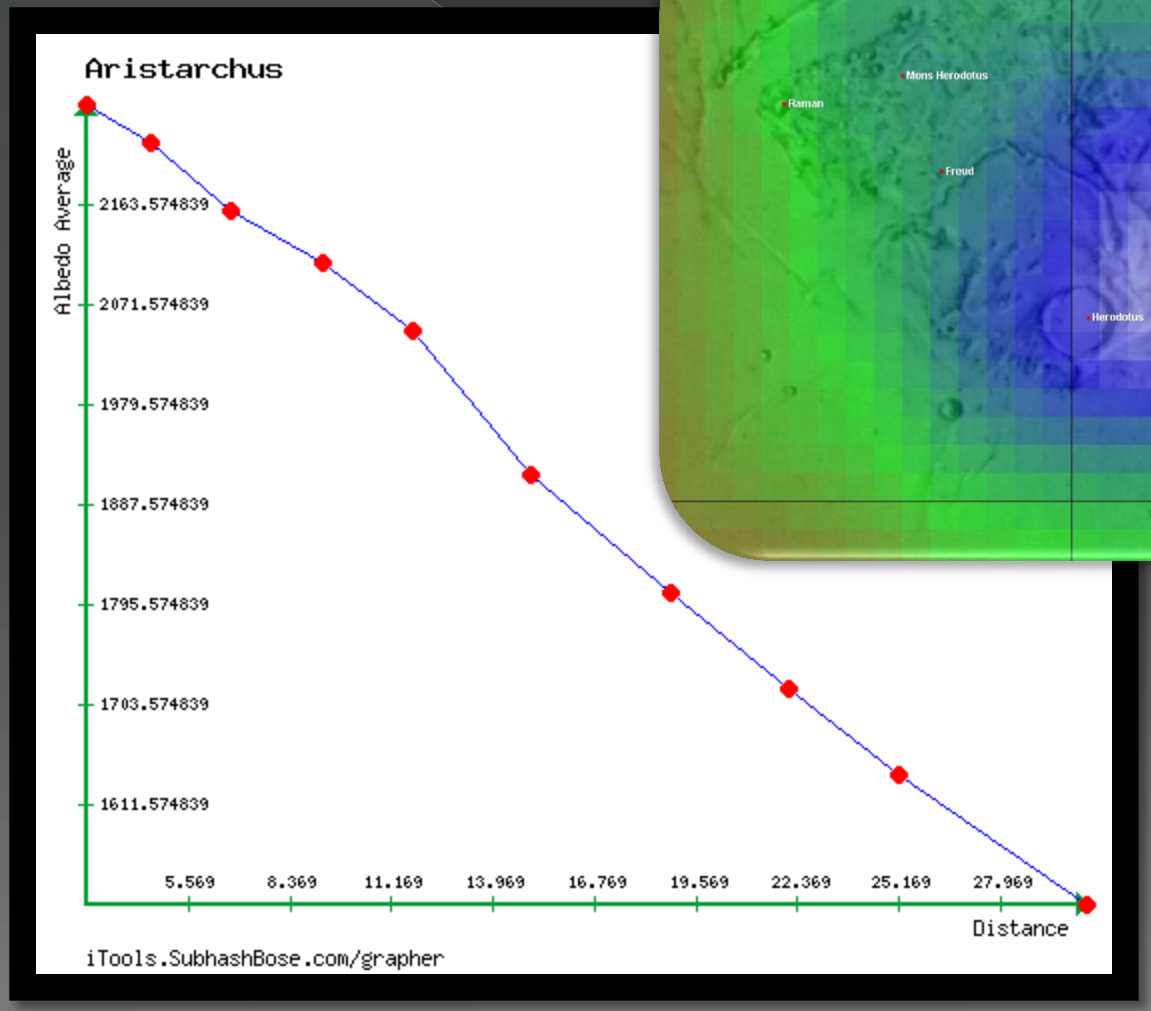
TiO2 Abundance: Light Blue- High, Dark Blue- Low

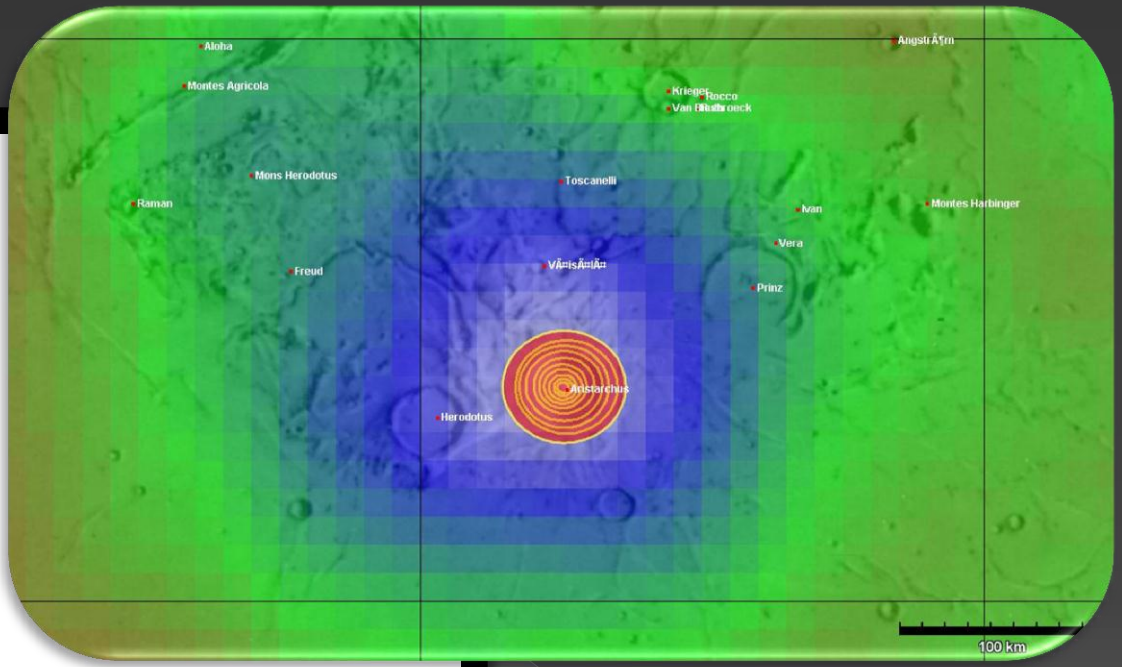
Aristarchus

- Impact Crater
- Near Aristarchus plateu
- Brightest of lunar formations
  - Albedo double most surface

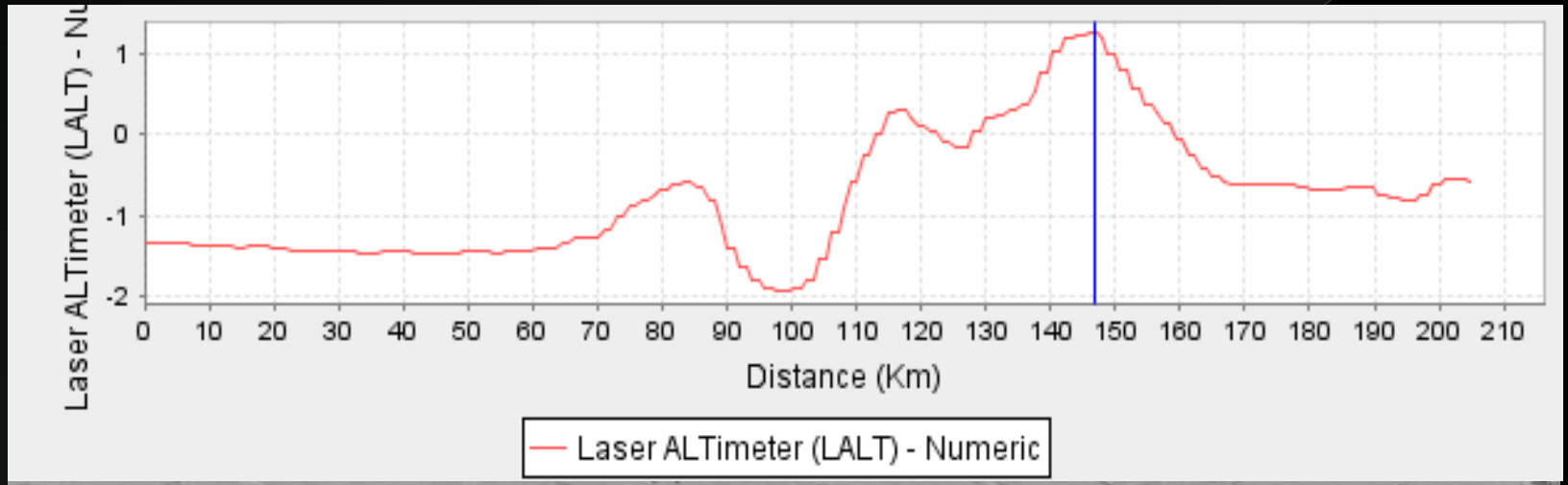


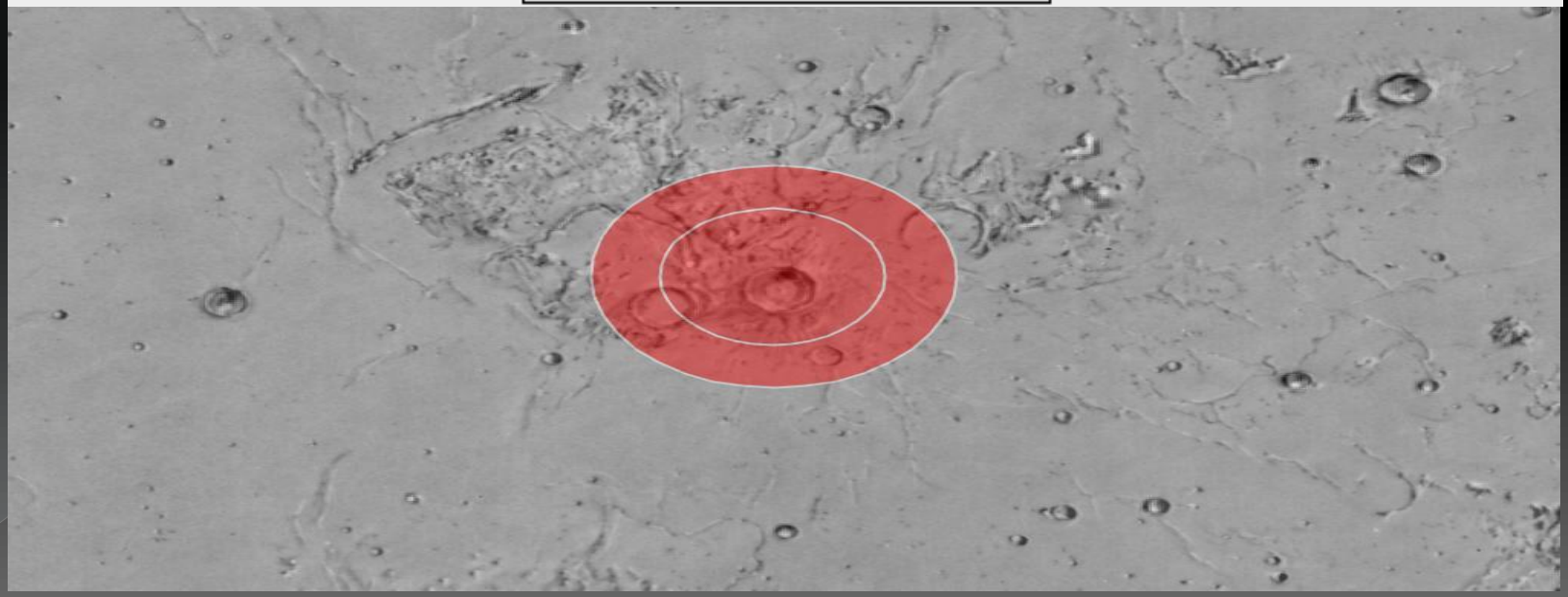
Aristarchus Albedo



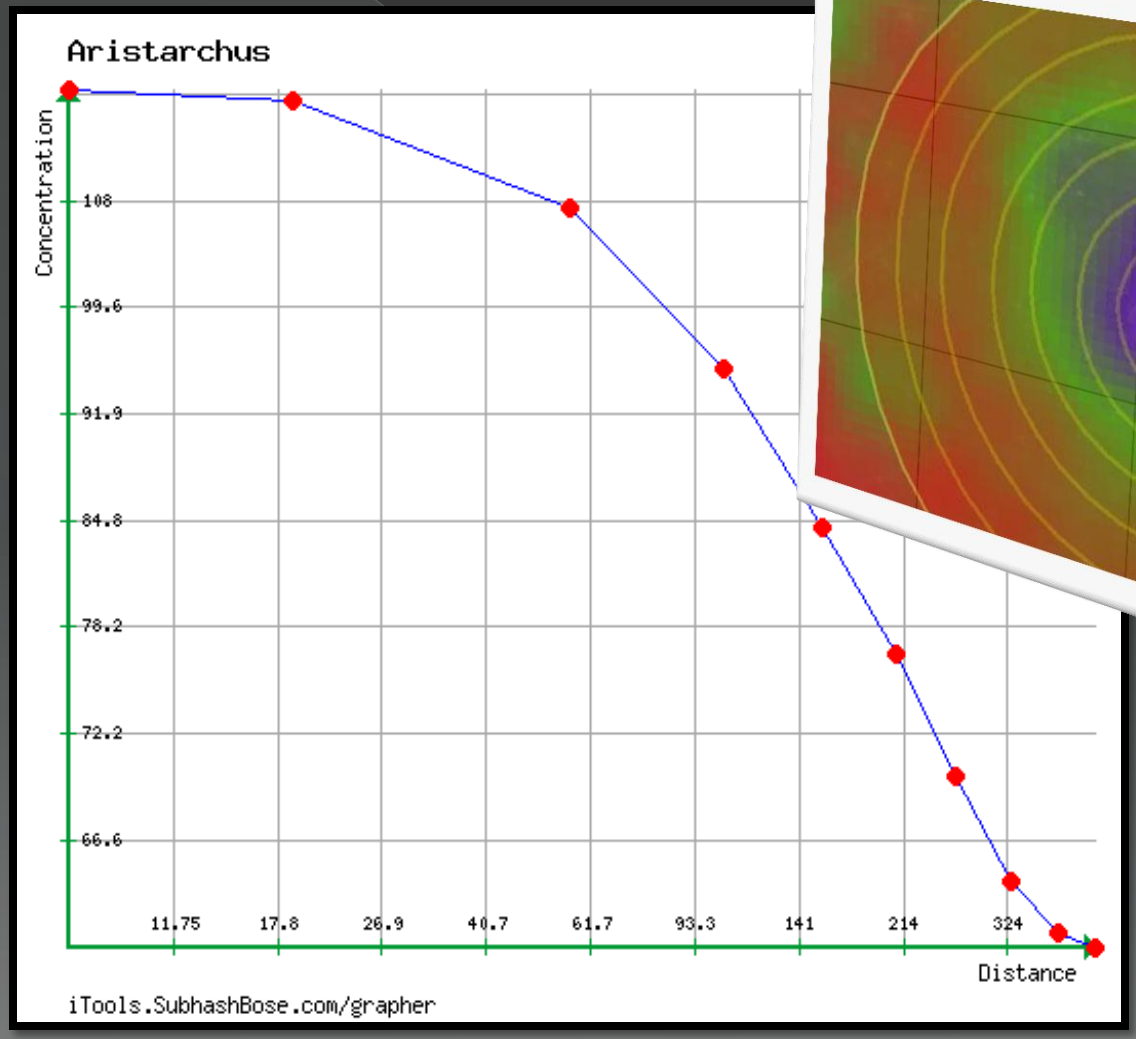


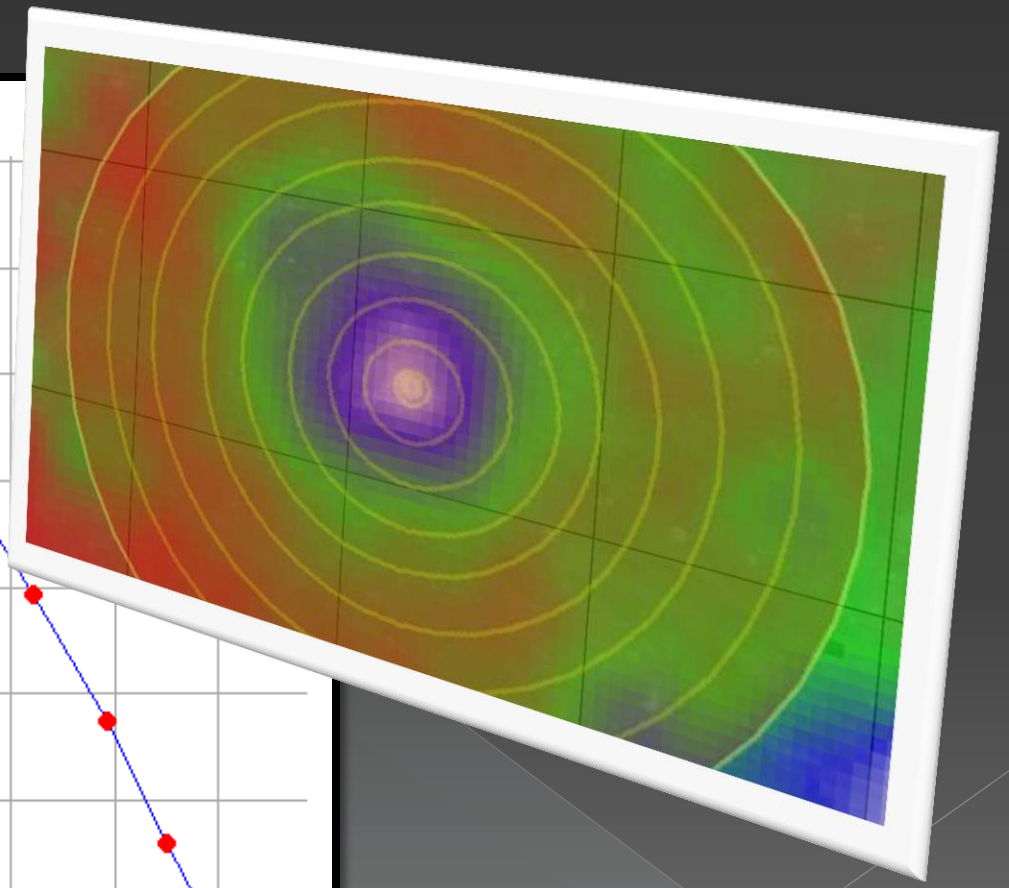
Aristarchus Elevation



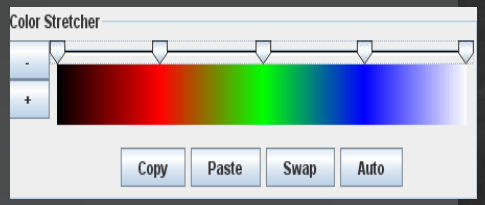


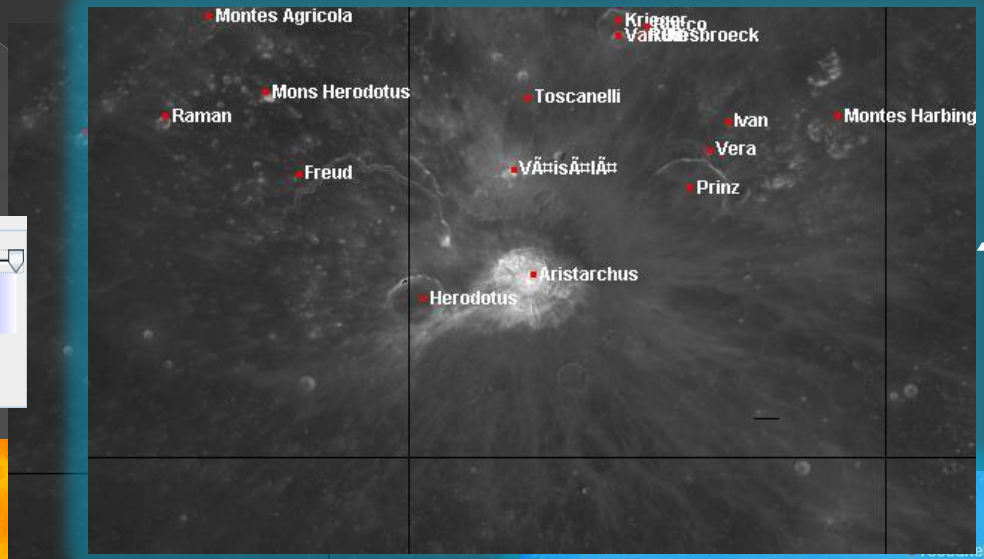
Aristarchus Th Deposits



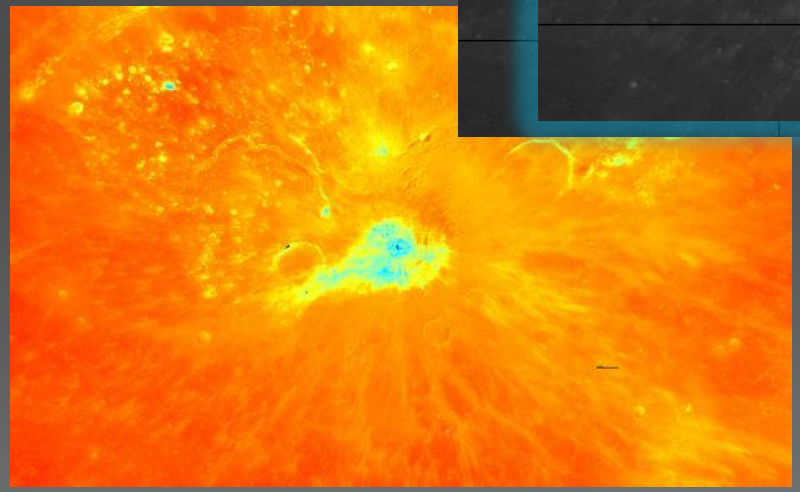


Aristarchus

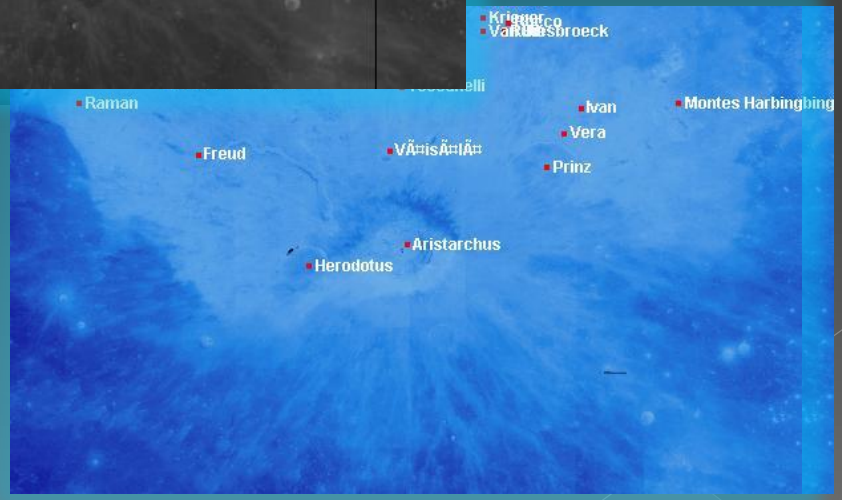




15 craters



FeO Iron(II) oxide Abundance (Dark-Low, Light- High)

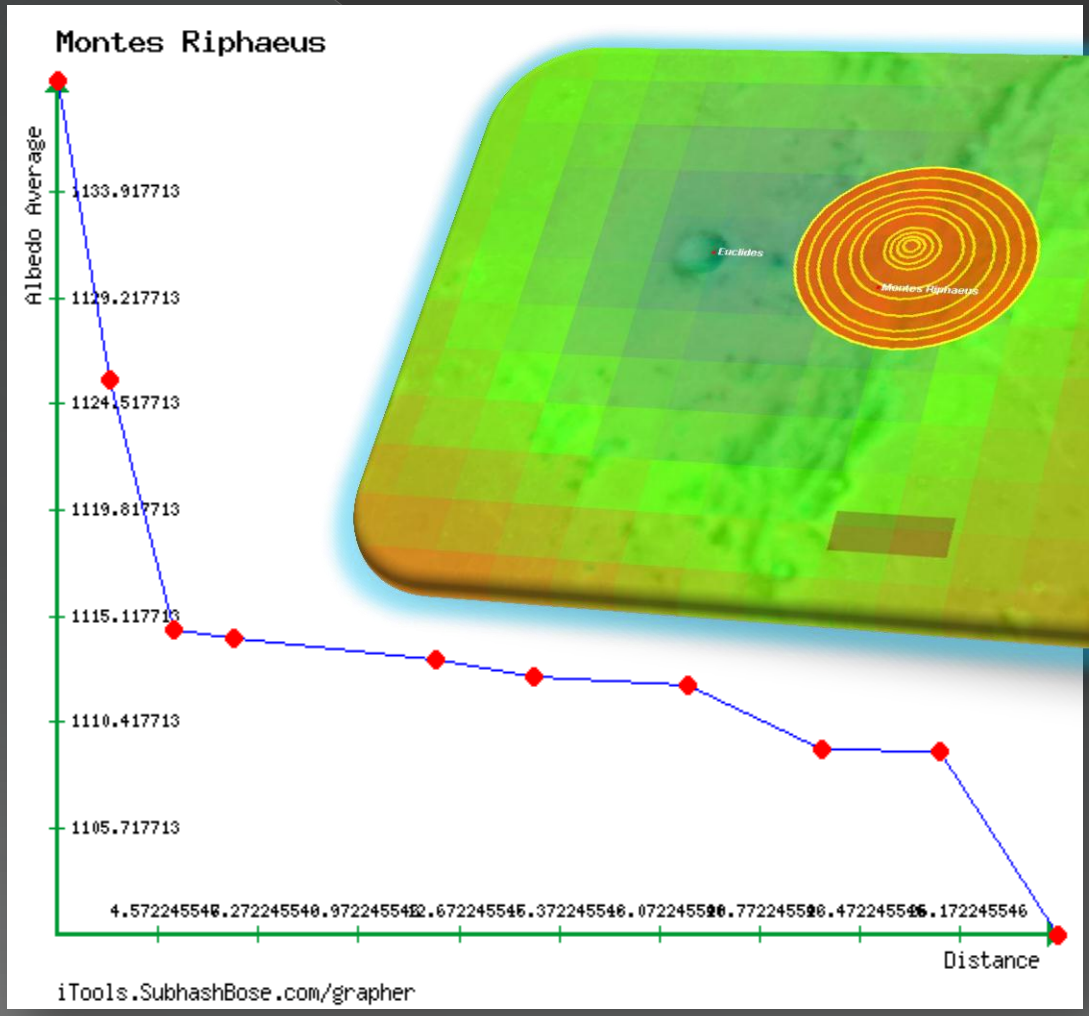


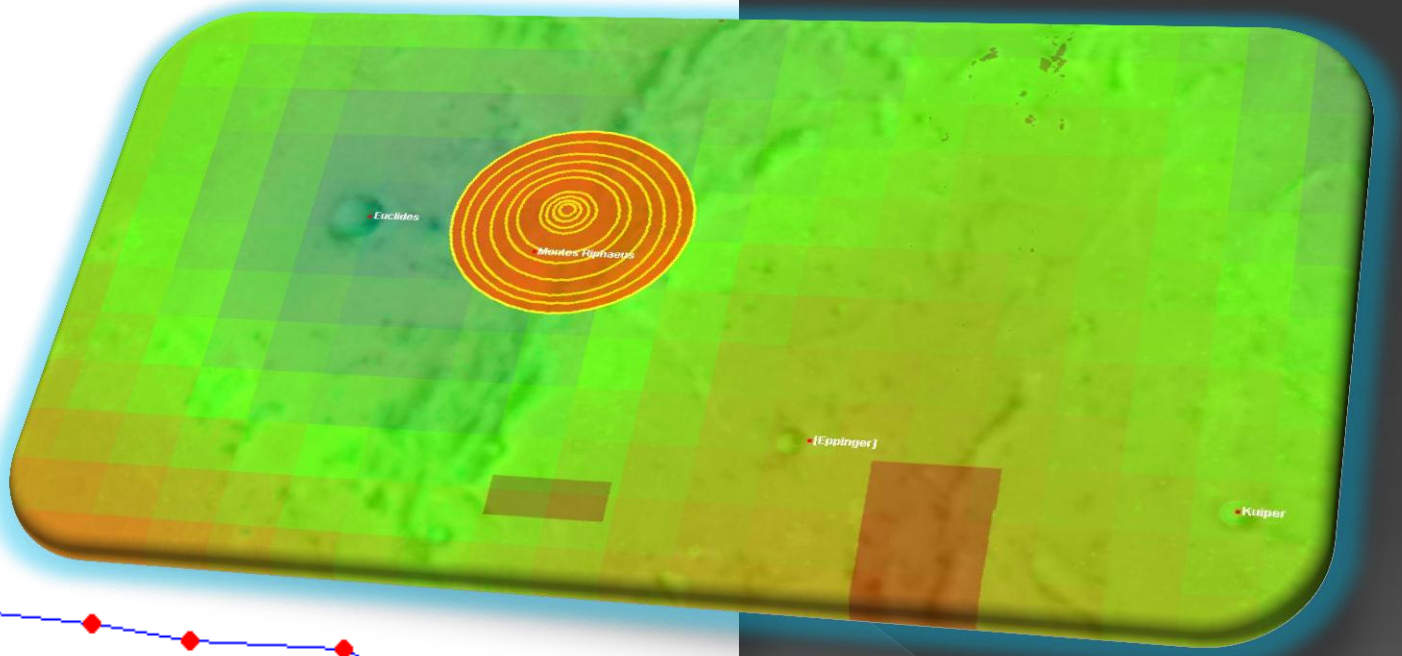
TiO2 Abundance: Light Blue- High, Dark Blue- Low

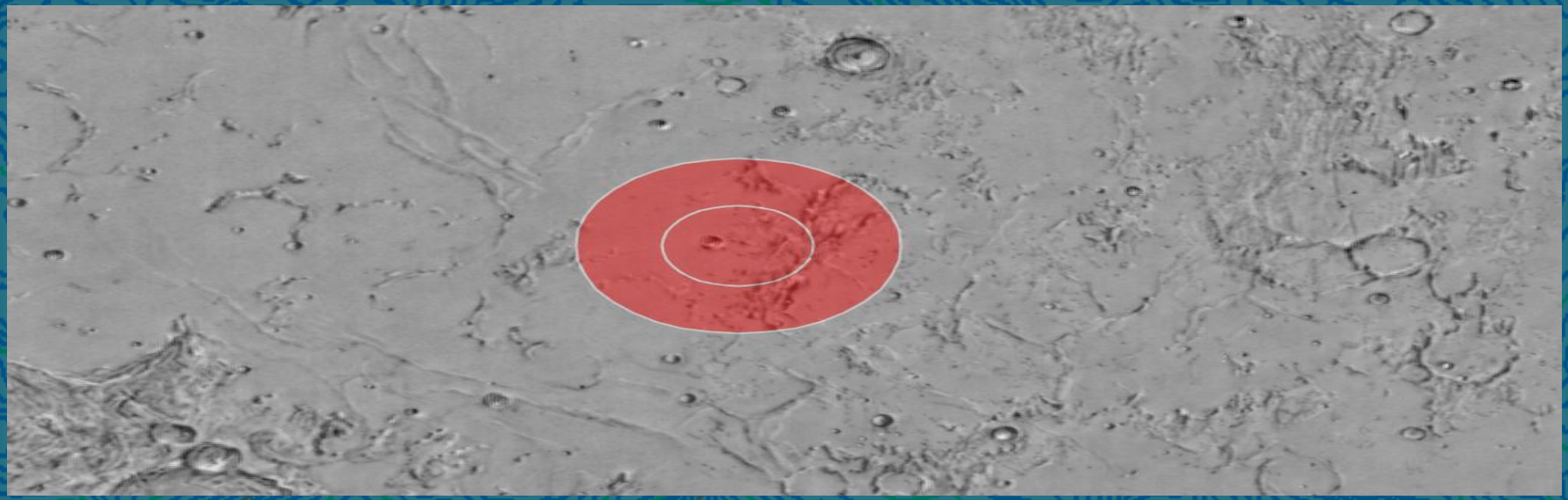
Montes Riphaeus

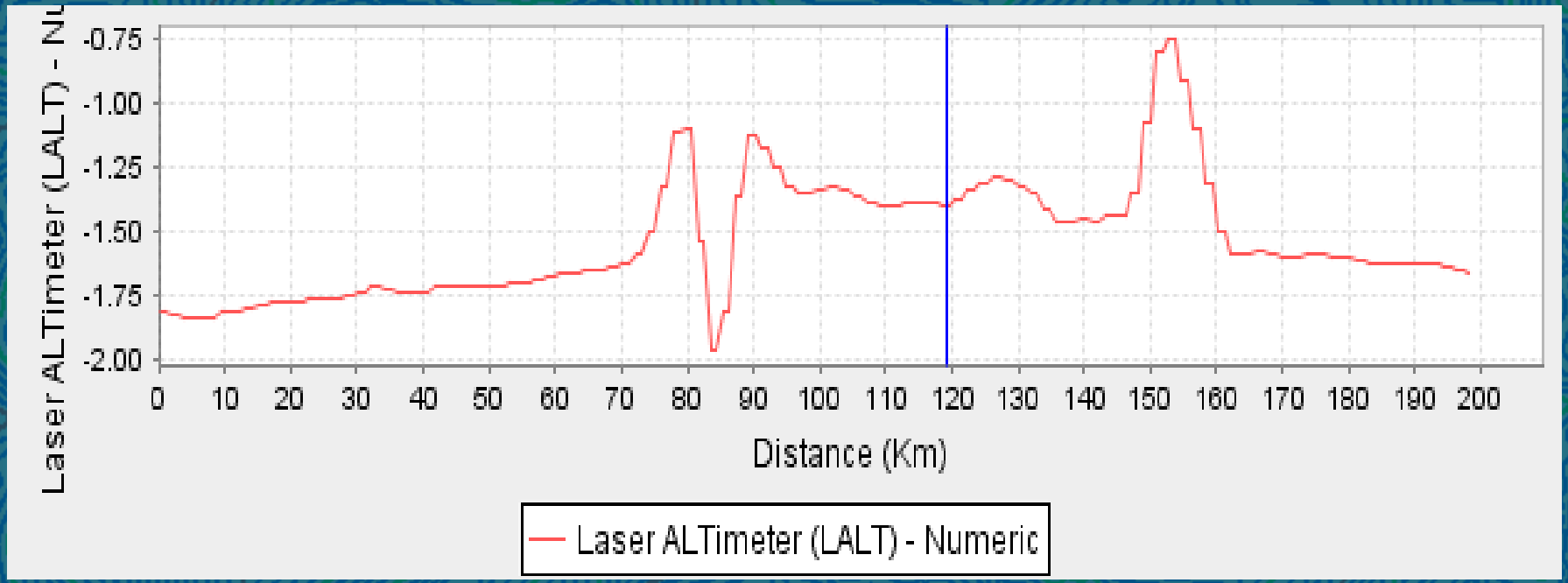
- Irregular range of lunar mountains
- Oceanus Procellarum
- Silicic Volcanoes
- In general vicinity of others
- Nearside
- Th Concentration

Montes Riphaeus Albedo








Laser ALTimeter (LALT) - Nu
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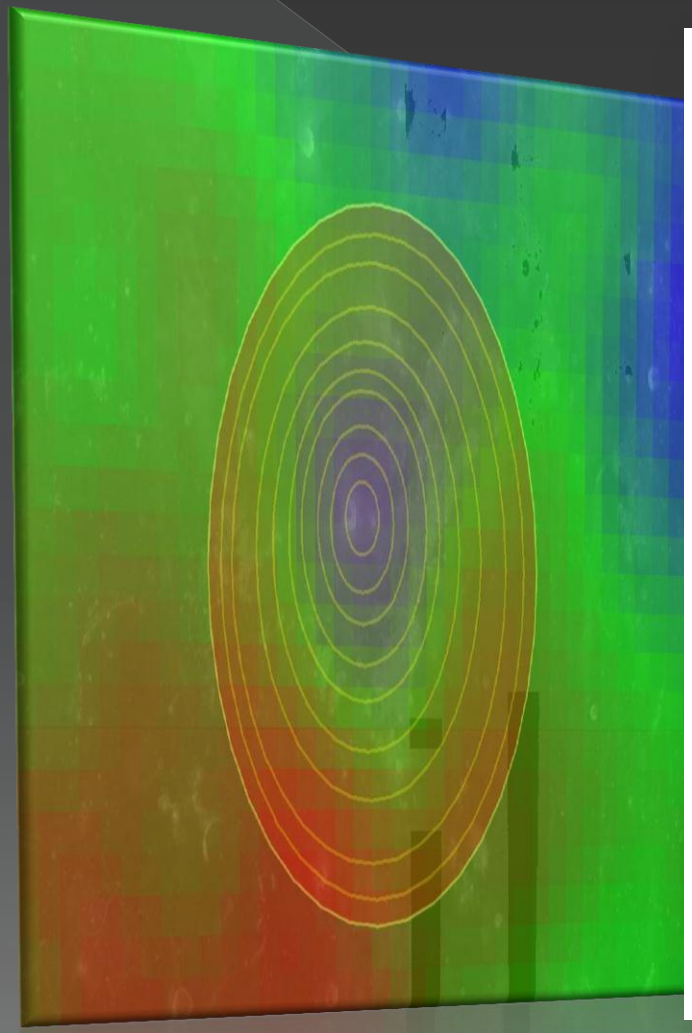
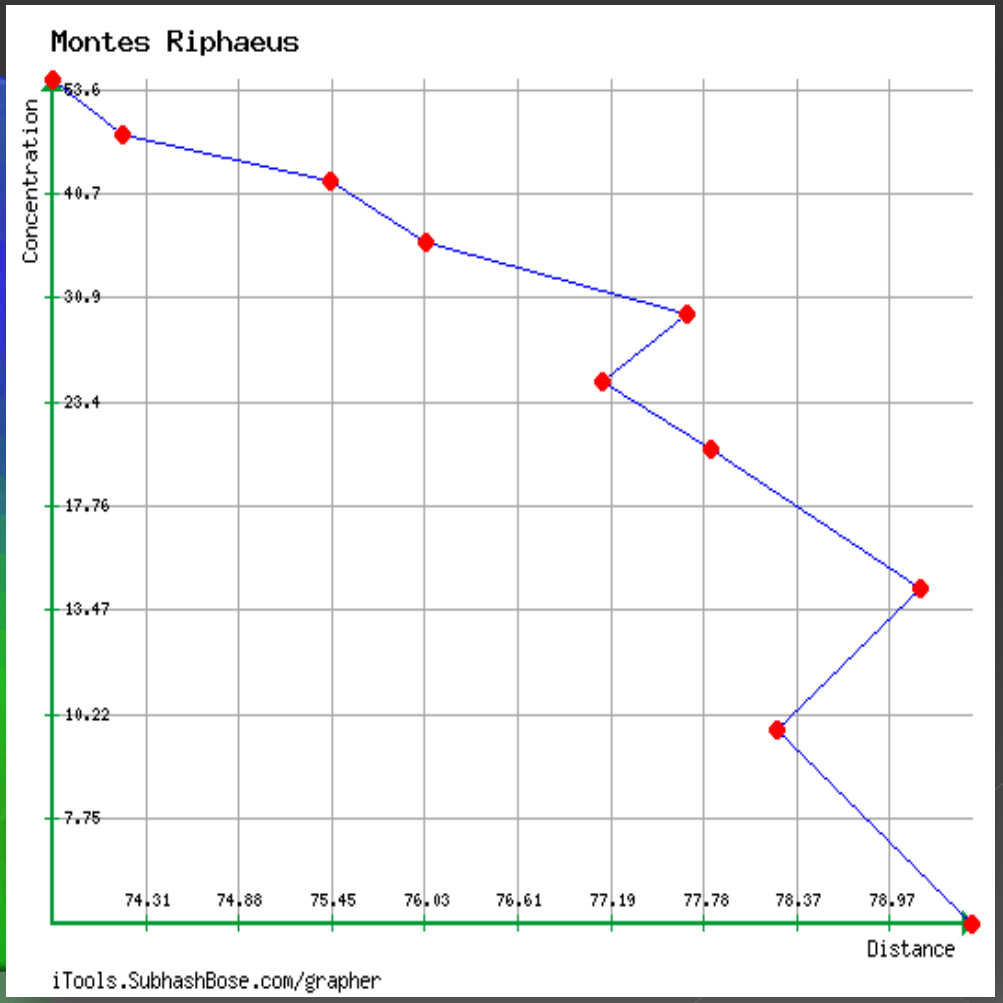
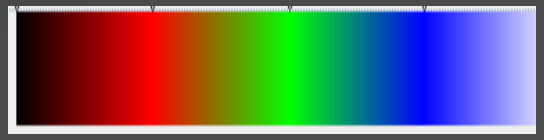
-1.00
-1.25
-1.50
-1.75
-2.00
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
Distance (Km)
Laser ALTimeter (LALT) - Numeric

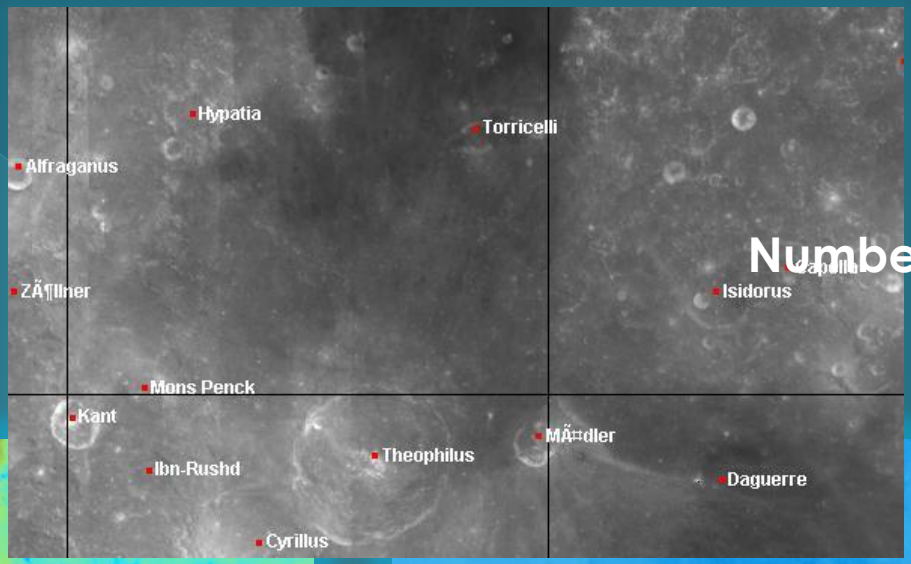
Montes Riphaeus Th Deposits



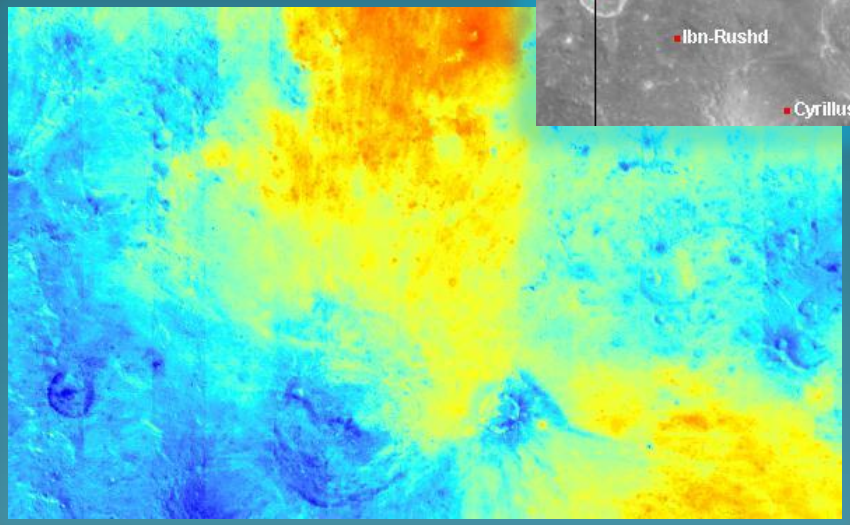


Montes Riphaeus

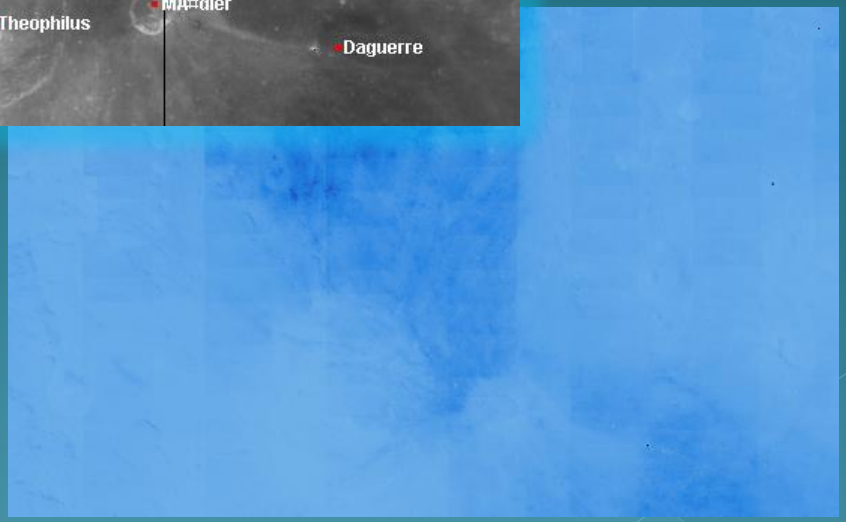




Number of Craters (13)



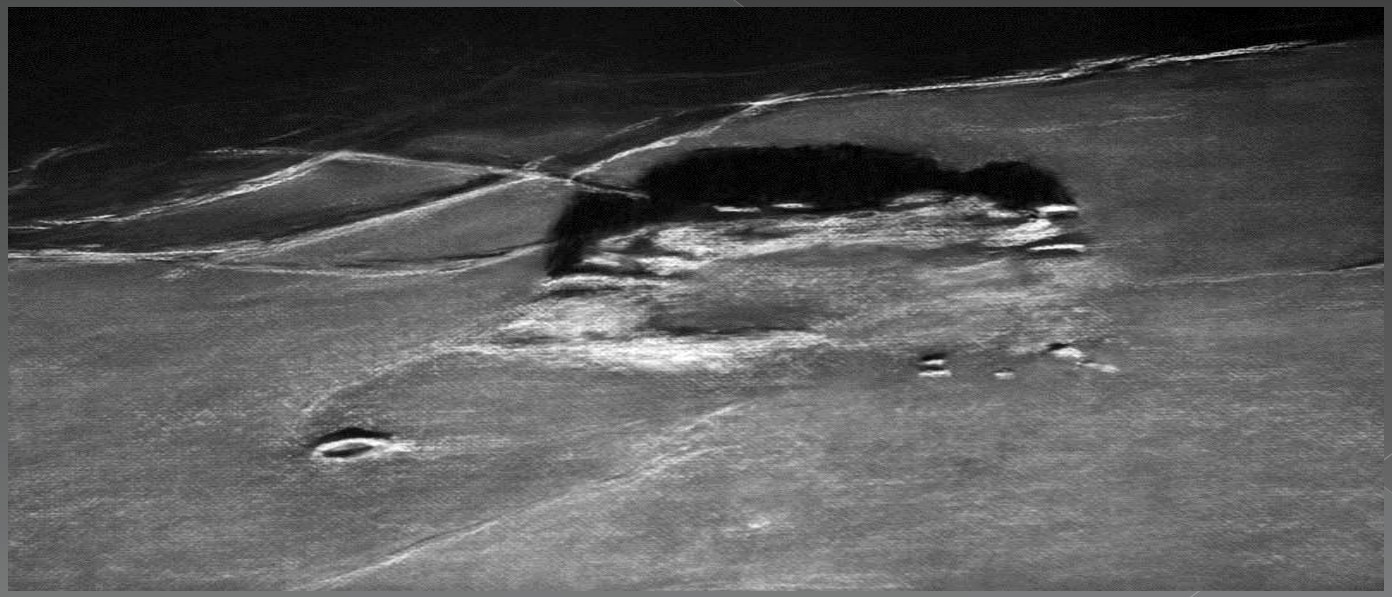
FeO Abundance (Dark-Low, Light- High)



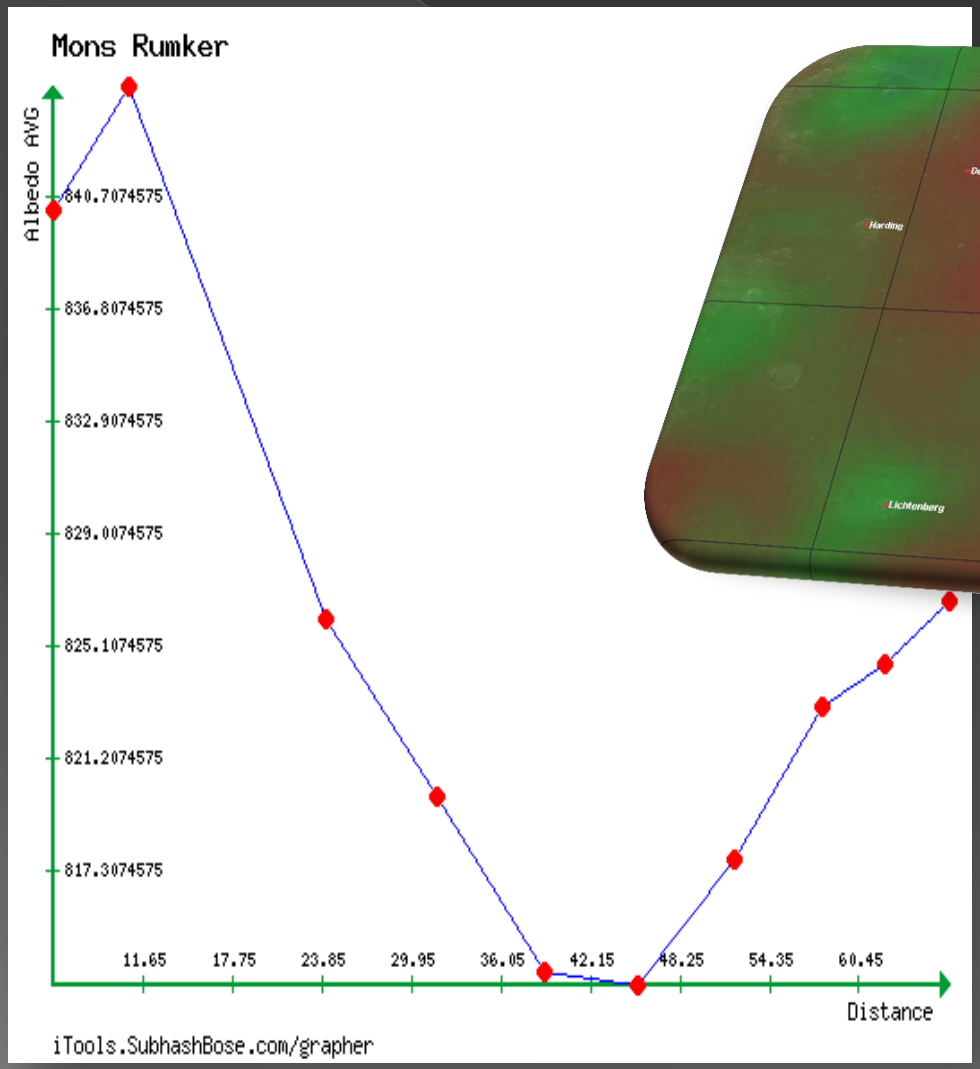
TiO2 Abundance: Light Blue- High, Dark Blue- Low

Mons Rumker

- Basaltic
- Significance
- Differences to Silicic



Mons Rumker


Mons Rumker
Albedo AVG
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817.3074575
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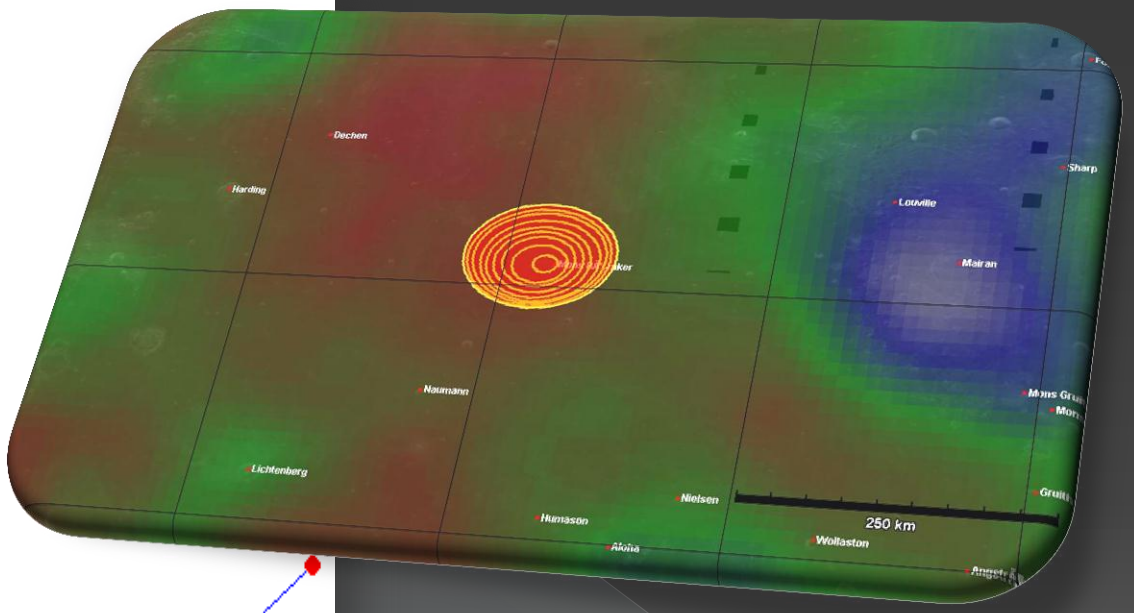
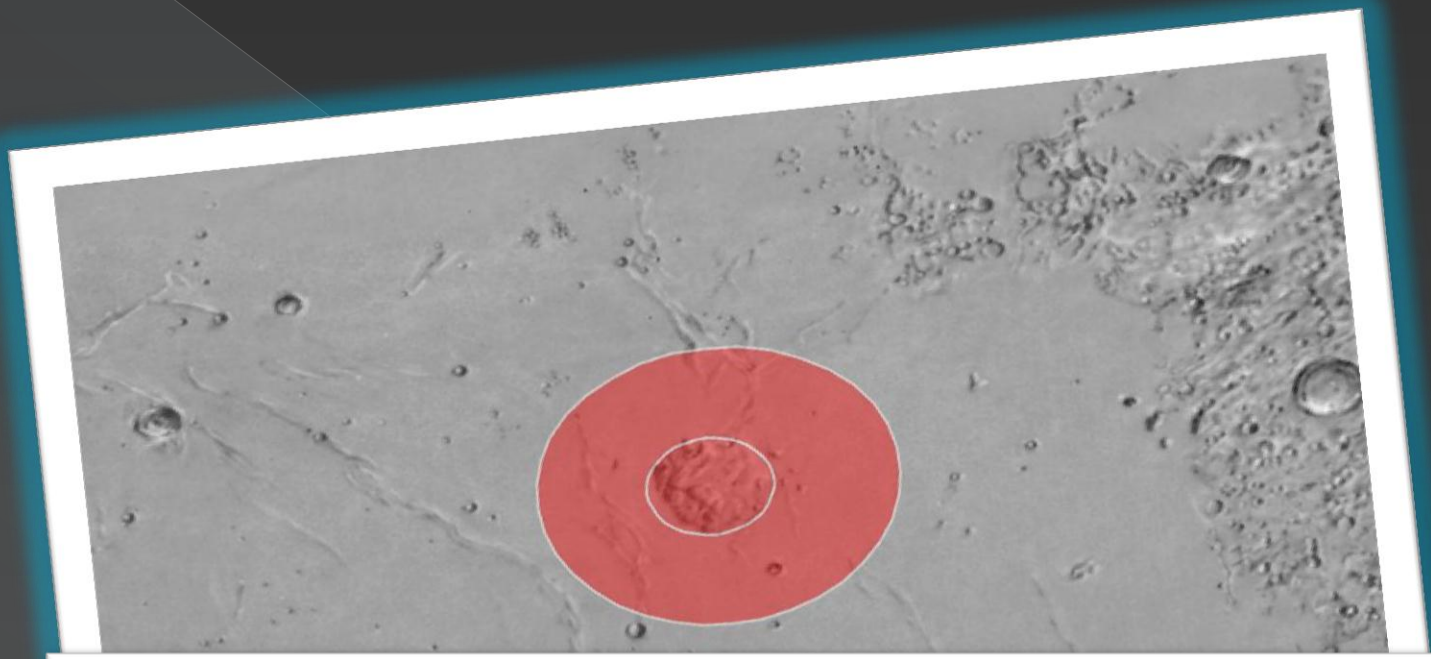
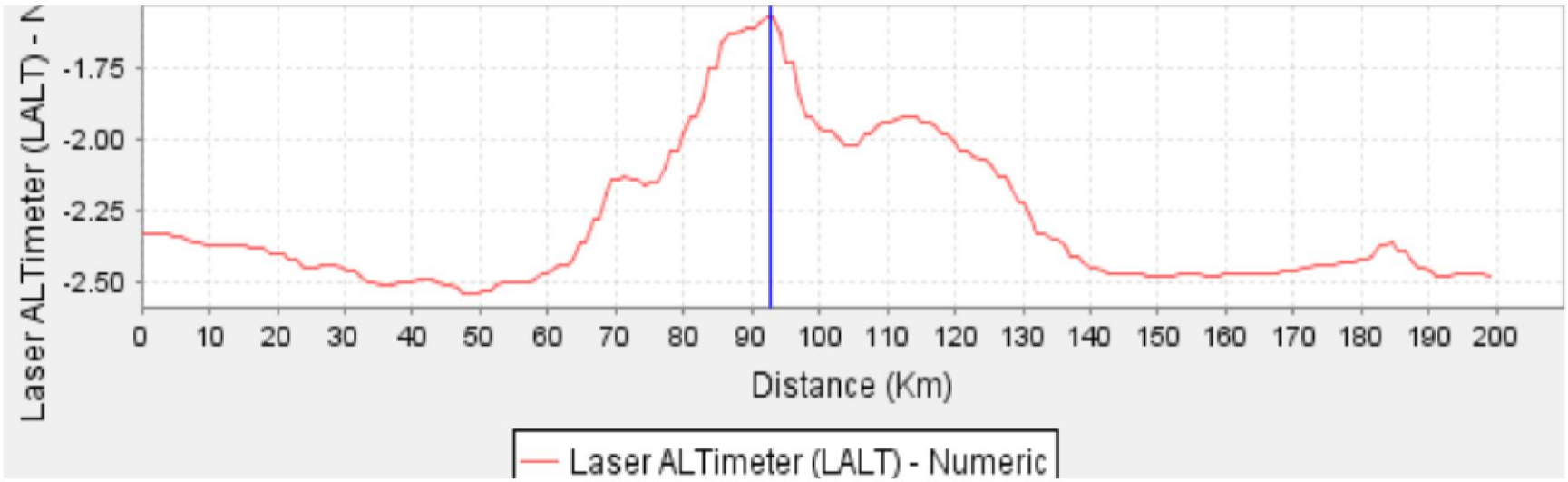
23.85
29.95
36.05
42.15
48.25
54.35
60.45
Distance
iTools.SubhashBose.com/grapher

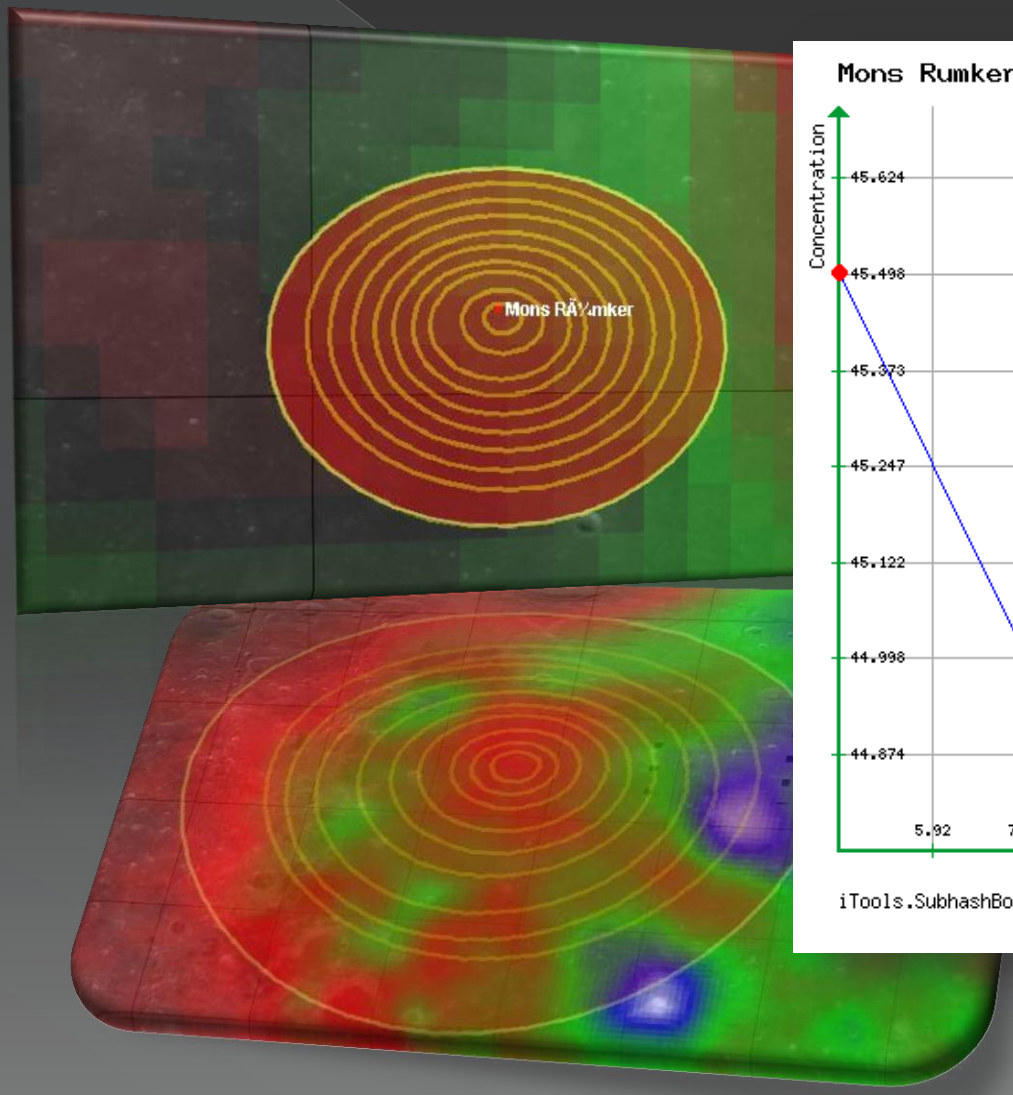

Dechen
Harding
Louville
Sharp
Mairan
Naumann
Lichtenberg
Nielsen
Humason
Wollaston
250 km

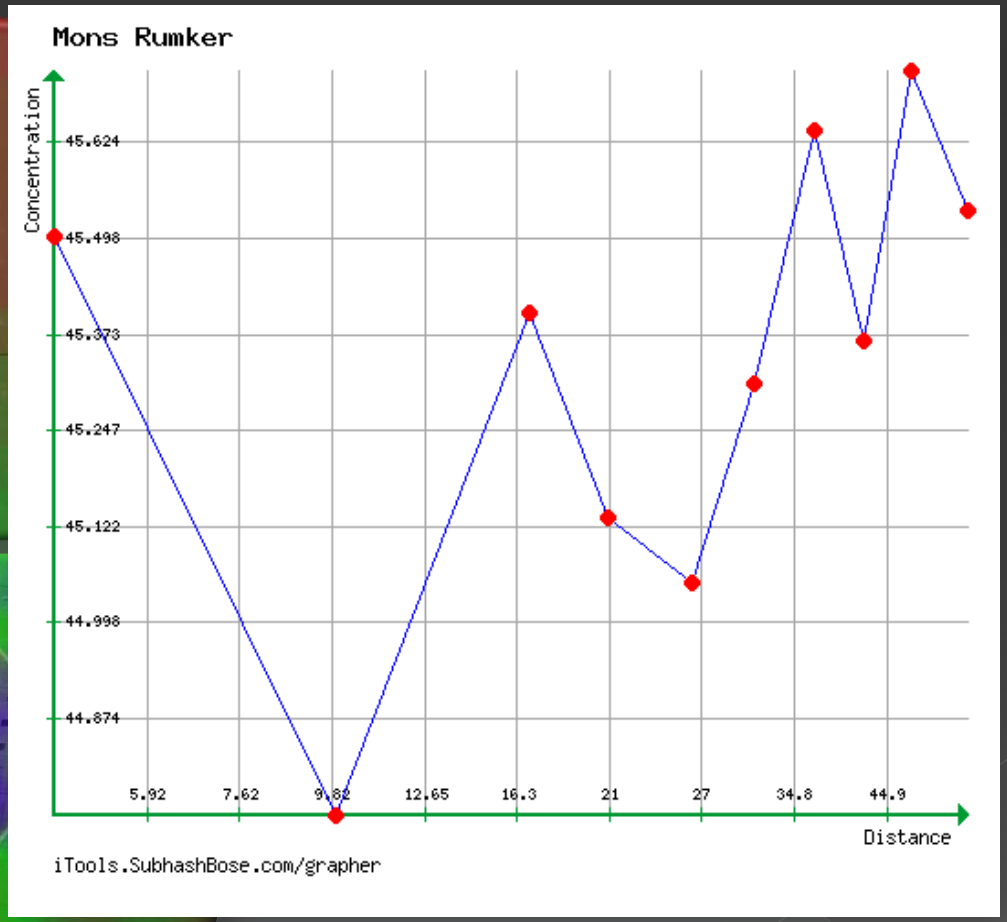
Basaltic: Mons Rümker



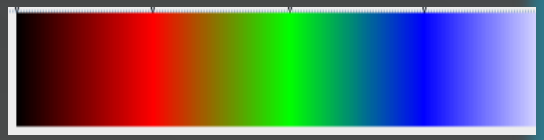


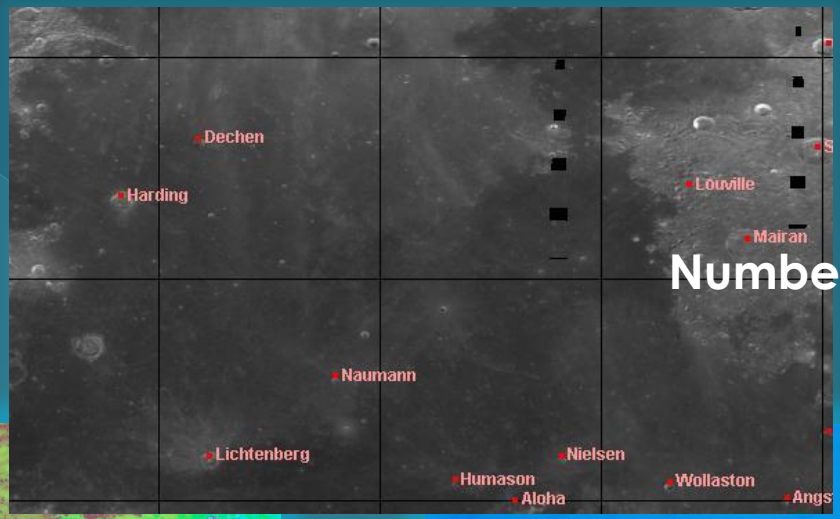
Mons Rumker


Mons RÃ¼mker

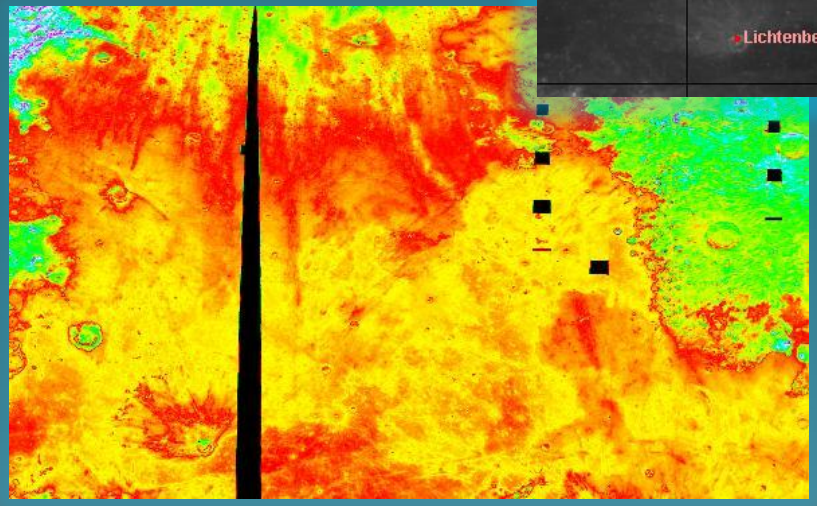

Mons Rumker
Concentration
45.624
45.498
45.373
45.247
45.122
44.998
44.874
5.92
7.62
9.82
12.65
16.3
21
27
34.8
44.9
Distance
iTools.SubhashBose.com/grapher

Mons Rumker

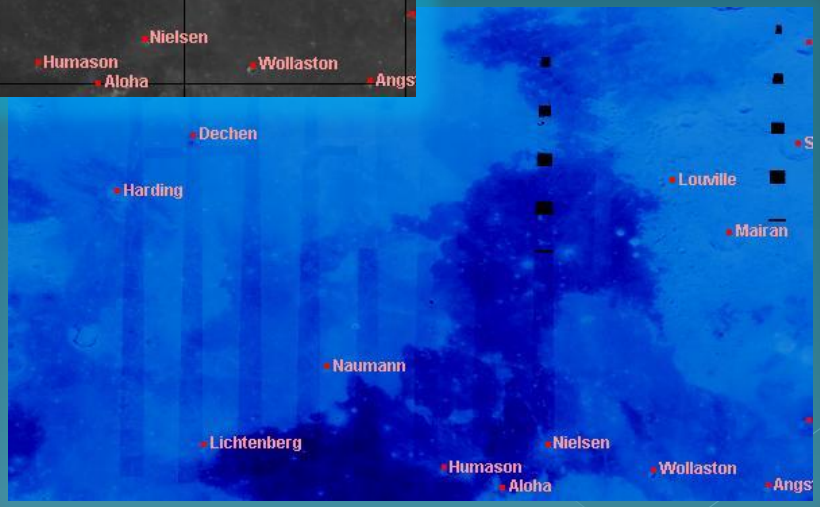




Number of Craters (14)



FeO Iron(II) oxide Abundance (Dark-Low, Light- High)



TiO2 Abundance: Light Blue- High, Dark Blue- Low

Analysis & Conclusion

How unique is CBF (Compton- Belkovich Feature) from other silicic volcanoes?

- Albedo- relationship of high elevation
  - Low elevation to low albedo value
  - High elevation to high albedo value
  - Albedo values at areas with high Th concentration
- Elevation
  - Consistent high elevation
  - CBF elevation is more widespread
- Th Distance/ Conentration
  - distance increases = thorium concentration
  - radius is small therefore more *thorium* concentration
  - Similar thorium for CBF and silicic volcanoes in the center
- Surrounding Geography/Geology
  - Measured by craters in given area (less)
  - Lower Abundance of FeO and TiO2

Further Research…

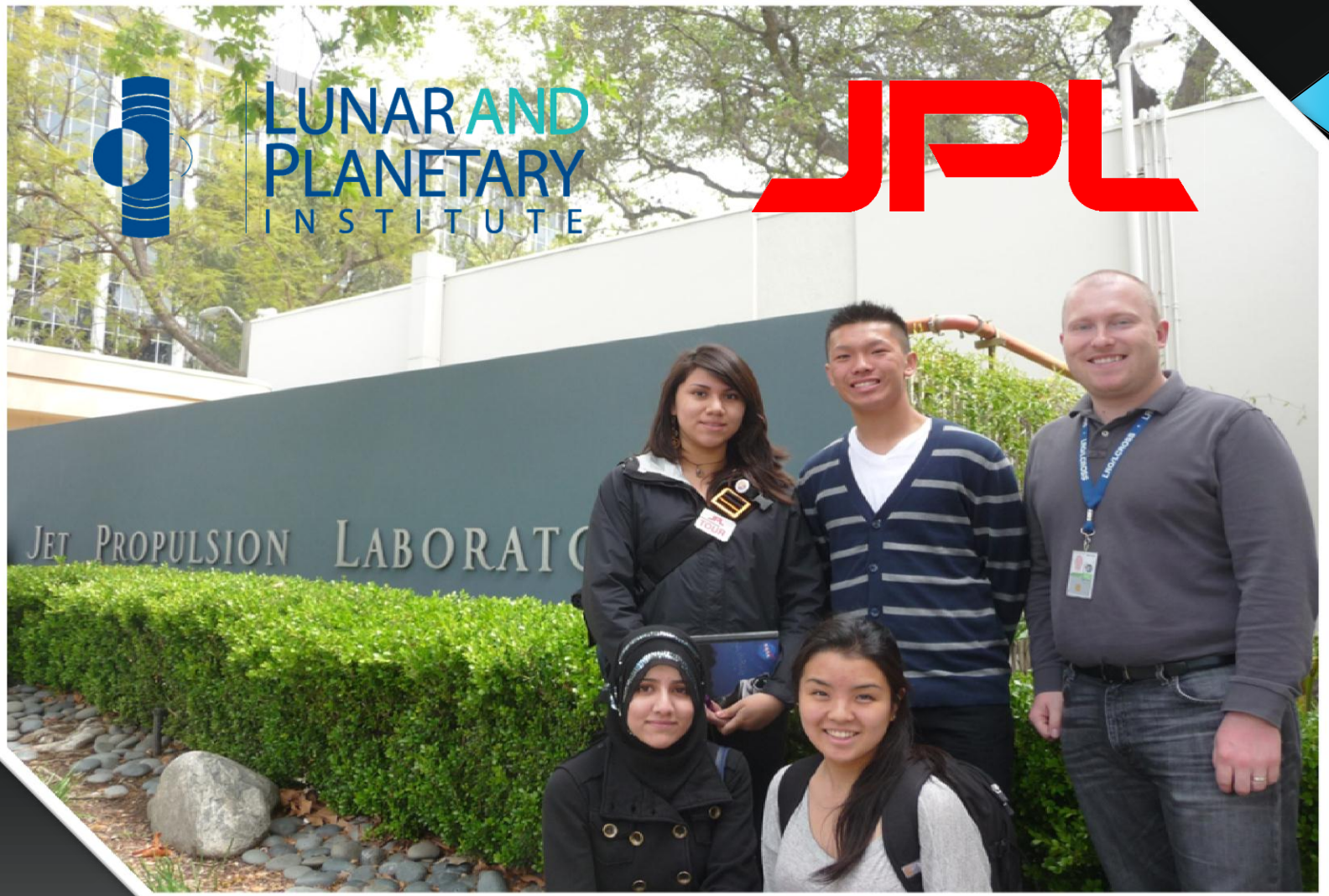
- Looking to include an out-group with a terrestrial example
  - Using specific software to see earth's silicic volcanoes
- Adding in other locations of nearside silicic volcanoes
- Analogies to volcanoes on earth
- Volcanoes on other planets
- Direct comparisons
  - e.g. plot albedo vs. distance for all volcanoes on a single chart

Special Thanks to…

- Benjamin Greenhagen
- Eric Godoy
- Nic West
- Roberta Brett

Programs used

- Microsoft Excel
- Microsoft Powerpoint
- JMars for the Moon



Careers in Science Interns

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